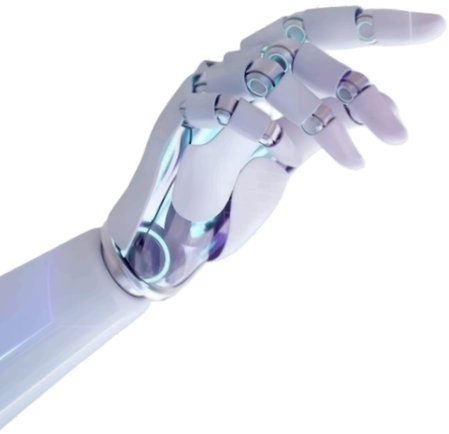
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Proceedings Book



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Assoc. Prof. Dr. Abdullah Faruk KILIÇ
Assist. Prof. Dr. Erhan VATANSEVER
Assist. Prof. Dr. Mustafa Zeki AYDOĞDU

Organized by Trakya University, Türkiye
Edirne, 2025

October 15-17, 2025

AI and the Future of Education: Transforming Teaching and Learning

The XVI. International Balkan Education and Science Congress has been completed, hosted by Trakya University.

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Foreword

Dear participants,

Welcome to the 16th International Balkan Education and Science Congress. Over the past three days, we have come together to share ideas, exchange experiences, and envision the future of education and science.

Our congress began with the group exhibition *"Graduate Alumni Gathering 3,"* where the creativity of our students and academics beautifully intertwined art and science. The Deans' Panel offered valuable discussions on the sustainability and future vision of the Balkan Congresses. Following this, Prof. Dr. Selçuk Özdemir's keynote address, *"Integration of Artificial Intelligence in the Classroom: Physical Reality in Education,"* and Prof. Dr. Mario Dumančić's talk, *"AI Pedagogical Agents: Opportunities, Challenges, and Future Perspectives,"* provided inspiring insights into the evolving relationship between artificial intelligence and education.

Throughout the parallel sessions, a wide range of topics—from virtual reality and digital learning skills to value education and special education—were presented. The active participation of scholars from various Balkan universities has been one of the most valuable outcomes of this event, strengthening both scientific collaboration and cultural ties.

Science and education transcend borders and build bridges between nations. We firmly believe that this congress will continue to foster academic and cultural cooperation among Balkan countries.

We extend our sincere gratitude to all participants for their contributions, and to our Rector, Prof. Dr. Mustafa Hatipler, the university administration, and all staff members for their support throughout this process.

We look forward to meeting again at our next congress.
With our best regards,

Prof. Dr. Eylem BAYIR
Dean of the Faculty of Education, Trakya University

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IBES 2025 Congress Report

TR

Trakya Üniversitesi Eğitim Fakültesi ev sahipliğinde, 15–17 Ekim 2025 tarihleri arasında Trakya Üniversitesi Balkan Kongre Merkezi'nde düzenlenen 16. Uluslararası Balkan Eğitim ve Bilim Kongresi, "Yapay Zeka ve Eğitimin Geleceği: Öğretmeyi ve Öğrenmeyi Dönüştürmek" temasıyla gerçekleştirilmiştir. Kongre, yapay zekânın eğitim süreçlerindeki etkilerini, fırsatlarını ve etik yönlerini çok boyutlu bir bakış açısıyla ele alarak, akademisyenleri, araştırmacıları, öğretmenleri ve sanat eğitimcilerini bir araya getirmiştir.

Kongreye 15 farklı ülkeden 199 katılımcı katılmış; toplam 226 bildiri sunulmuştur. Bu bildirilerin 217'si sözlü, 9'u poster bildiri olarak gerçekleştirilmiştir. Katılımcıların büyük çoğunluğu Türkiye'den olup; Bulgaristan, Yunanistan, Kuzey Makedonya, Kosova, Sırbistan, Hırvatistan, Romanya, Rusya Federasyonu, Hollanda ve Katar gibi ülkelerden bilim insanları da kongreye önemli katkılar sunmuştur. Bu çeşitlilik, Balkanlar'daki akademik dayanışmanın güçlenmesini ve uluslararası bilimsel iş birliğinin gelişimini desteklemiştir.

Kongrede iki çağrılı konuşmacı yer almıştır. Prof. Mario Dumančić (Zagreb Üniversitesi) "AI Pedagogical Agents: Opportunities, Challenges, and Future Perspectives" başlıklı sunumunda yapay zekâ tabanlı öğretim ajanlarının eğitimdeki rolünü değerlendirmiş; Prof. Selçuk Özdemir (Gazi Üniversitesi) ise "Integration of AioT into Classroom: The Physical Reality in Education" başlıklı konuşmasıyla yapay zekâ ve nesnelerin interneti uygulamalarının sınıf ortamına entegrasyonunu ele almıştır. Ayrıca, Dr. Sertaç Arabacıoğlu (Trakya University), Dr. Sanae Okamoto (United Nations University – MERIT), Dr. Nidhi Nagabhatla (University of Ghent and UNU CRIS), Dr. Elif Ülker Demirel (Trakya University) tarafından gerçekleştirilen "Teaching Climate Change Beyond Facts: Pioneering Pedagogies, Mental Health and Science-Policy Interfaces" başlıklı panel oturumu, eğitim, iklim değişikliği, zihinsel sağlık ve bilim-politika etkileşimleri arasında disiplinlerarası bir tartışma ortamı sunmuştur.

Kongre kapsamında yapay zekâ destekli öğrenme sistemleri, kişiselleştirilmiş eğitim, etik konular, öğretmen yetiştirme, ölçme-değerlendirme, duygusal yapay zekâ, özel eğitim, dijital okuryazarlık, yaşam boyu öğrenme ve kapsayıcı eğitim gibi geniş bir yelpazede bildiriler sunulmuştur. Trakya Üniversitesi Eğitim Fakültesi Güzel Sanatlar Eğitimi Bölümü tarafından gerçekleştirilen "Undergraduate Alumni Reunion 3" sergisi ise, bilimsel içerikle sanatsal üretimi buluşturarak kongreye kültürel bir boyut kazandırmıştır.

Sonuç olarak, kongre Balkanlar ve ötesinde yapay zekâ temelli eğitim araştırmalarını güçlendirmiş, uluslararası akademik iş birliklerinin gelişmesine zemin hazırlamıştır. 16. Uluslararası Balkan Eğitim ve Bilim Kongresi, yenilikçi, kapsayıcı ve insan merkezli bir eğitim anlayışının gelişimine yön veren, bölgesel ve küresel ölçekte etkili bir bilimsel buluşma olmuştur.

ENG

Hosted by the Faculty of Education at Trakya University, the 16th International Balkan Education and Science Congress took place between October 15–17, 2025, at the Balkan Congress Center in Edirne, Türkiye, under the theme "AI and the Future of Education: Transforming Teaching and Learning" The congress offered a comprehensive platform for discussing the transformative role of artificial intelligence in education, addressing pedagogical, ethical, and technological perspectives.

A total of 199 participants from 15 countries attended the congress, where 226 papers were presented, including 217 oral presentations and 9 poster sessions. While most participants came from Türkiye, researchers from Bulgaria, Greece, North Macedonia, Kosovo, Serbia, Croatia, Romania, the Russian Federation, the Netherlands, and Qatar also made valuable contributions. This international diversity reflected the growing academic cooperation and scientific dialogue across the Balkan region and beyond.

The congress featured two distinguished keynote speakers: Prof. Mario Dumančić (University of Zagreb) delivered his talk titled "AI Pedagogical Agents: Opportunities, Challenges, and Future Perspectives," exploring the role of AI-driven pedagogical agents in education; and Prof. Selçuk Özdemir (Gazi University) presented "Integration of AioT into Classroom: The Physical Reality in Education," addressing the integration of AI and IoT in classroom environments. Additionally, the panel session titled "Teaching Climate Change Beyond Facts: Pioneering Pedagogies, Mental Health and Science-Policy Interfaces," conducted by Dr. Sertaç Arabacıoğlu (Trakya University), Dr. Sanae Okamoto (United Nations University – MERIT), Dr. Nidhi Nagabhatla (University of Ghent and UNU CRIS), and Dr. Elif Ülker Demirel (Trakya University), provided an interdisciplinary platform for dialogue connecting education, climate change, mental health, and science-policy interactions.

Throughout the event, participants presented studies on topics such as AI-enhanced learning systems, personalized education, ethics in AI, teacher education, assessment and feedback, emotional AI, special and inclusive education, digital literacy, and lifelong learning. The "Undergraduate Alumni Reunion 3" group exhibition, organized by the Department of Art and Craft Education, added an artistic dimension, uniting creativity with educational research.

In conclusion, the congress strengthened AI-based educational research in the Balkans, provided a platform for international collaboration, and contributed to shaping an innovative, inclusive, and human-centered vision for the future of education. The 16th International Balkan Education and Science Congress stands as a significant academic gathering with lasting regional and global influence.

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Bridging Scientific Gaps: How Primary School Teachers Can Use ChatGPT to Support Science Education

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Abstract

The integration of artificial intelligence in education has created novel opportunities for re-evaluating pedagogy, especially within primary science education. ChatGPT, as a generative language model, has garnered significant interest among emerging technologies for its ability to assist educators in lesson planning, facilitating inquiry, and delivering personalized learning experiences. This paper investigates the utilization of ChatGPT to address scientific and pedagogical deficiencies in primary classrooms, referencing constructivist and socio-constructivist viewpoints that prioritize inquiry, collaboration, and active participation in science education. The analysis emphasizes ChatGPT's capability to aid in the creation of interactive worksheets, facilitate experimental activities, and promote interdisciplinary links with STEM and sustainability themes. The paper concurrently examines the challenges of AI integration, including teacher readiness, ethical issues like bias and data privacy, and infrastructural disparities in various global contexts. Significant emphasis is placed on professional development as a prerequisite for the meaningful and responsible integration of ChatGPT, ensuring that educators are equipped to utilize it not as a replacement for pedagogy, but as a facilitator of creativity and critical thinking. This paper posits that ChatGPT possesses transformative potential in the context of international discussions on educational equity, provided it is integrated within strong ethical and institutional frameworks.

Keywords: ChatGPT, primary science education, inquiry-based learning, teacher professional development, educational equity.

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Introduction

In recent years, the swift progression of Artificial Intelligence (AI) has transformed the educational landscape, providing unparalleled opportunities to reconsider pedagogy across all educational levels. The role of AI in primary science education is becoming increasingly essential and promising. Primary schools frequently serve as the initial formal environments in which children engage with structured scientific concepts, and the caliber of instruction during these formative years profoundly influences their attitudes toward science and their future scientific literacy (Bybee, 2013; Osborne & Dillon, 2008). Teachers at the primary level often encounter structural obstacles, such as restricted access to laboratory resources, inadequate curriculum time allocated for experimentation, and inconsistent professional preparation in scientific content knowledge (Harlen, 2010). These obstacles have resulted in disparities in teaching methodologies and student learning outcomes, especially in environments where science is regarded as a secondary rather than primary element of early education.

The advent of generative AI platforms, such as ChatGPT, offers a novel means to address these disparities. ChatGPT operates as a conversational agent proficient in providing customized explanations, facilitating inquiry, and assisting educators in lesson planning. Its adaptive capabilities correspond with the principles of socio-constructivist learning, wherein knowledge is collaboratively constructed through dialogue and interaction (Vygotsky, 1978). Instead of supplanting the teacher, ChatGPT functions as an auxiliary resource that enhances the educator's ability to tailor instruction, address varied student requirements, and promote engagement with scientific concepts. Studies indicate that generative AI can augment student engagement, promote inquiry-based methodologies, and provide instantaneous feedback that enriches comprehension of abstract scientific concepts (Ahmadi et al., 2023; Almasri et al., 2024; Kotsis, 2024a; Kotsis, 2024).

The incorporation of AI into primary education raises several concerns. Researchers have emphasized ethical dilemmas, such as data privacy, algorithmic bias, and the potential for excessive dependence on automated systems (FattahiBavandpour, 2024; Elifas & Simuja, 2024). Moreover, rural schools and underfunded environments may lack the necessary infrastructure to fully leverage AI-driven innovations, thereby highlighting concerns regarding equity and access. These factors necessitate that the implementation of ChatGPT in education be regarded not merely as a technological advancement but also as a pedagogical strategy, guided by principles of inclusivity, critical engagement, and teacher professional development.

This paper aims to investigate the meaningful integration of ChatGPT into primary science education to tackle ongoing challenges and simultaneously create new opportunities for active learning and student engagement. This article seeks to offer a thorough perspective on how AI can assist primary school teachers in promoting scientific literacy by contextualizing ChatGPT within the historical framework of educational technology, analyzing its pedagogical benefits, and critically addressing its challenges. This approach addresses an expanding global discourse regarding the role of AI in education, transcending mere technological optimism to present a nuanced perspective that incorporates both opportunities and obligations.

Theoretical Foundations

The incorporation of ChatGPT into primary science education is most effectively analyzed through the perspectives of constructivist and socio-constructivist theories, which highlight the proactive involvement of learners in knowledge construction. Based on Piaget's (1972) developmental framework, constructivism posits that children acquire scientific knowledge not through passive information absorption, but by engaging with their surroundings and constructing and modifying mental models. Bruner (1961) enhanced this viewpoint by emphasizing discovery learning, wherein learners interact with problems and concepts through exploration and inquiry. In this context, ChatGPT serves as a scaffolding instrument, facilitating inquiry through explanations, counter-questions, or recommendations for experimentation.

The socio-constructivist theory, as proposed by Vygotsky (1978), emphasizes the centrality of social interaction and language in the learning process. His notion of the zone of proximal development (ZPD) underscores the significance of guidance in facilitating learners' advancement beyond their independent

capabilities. When integrated judiciously, ChatGPT can serve as a digital scaffold, enhancing the Zone of Proximal Development by offering immediate feedback and tailoring explanations to the learner's comprehension level. This potential closely aligns with inquiry-based and problem-based science education, which depend on dialogue, collaboration, and iterative questioning (Driver et al., 1994).

Critics have expressed apprehensions that excessive dependence on AI could diminish genuine teacher-student interaction (Selwyn, 2021). Emerging research indicates that when teachers adopt a mediating role, ChatGPT can augment rather than hinder inquiry processes. Research in higher education indicates that AI prompts can enhance student reflection and facilitate participation in active learning activities (Jayasinghe, 2024). In primary classrooms, this indicates that ChatGPT should not supplant teacher guidance but rather serve as an ancillary resource that enhances students' capacity to investigate, hypothesize, and derive meaning.

The theoretical underpinnings of constructivism and socio-constructivism offer a compelling pedagogical rationale for ChatGPT's involvement in science education. The tool can enhance the learning process by facilitating exploration, scaffolding inquiry, and promoting collaborative dialogue. Its efficacy, however, relies on the intentional incorporation by educators who can synchronize AI outputs with curricular goals and classroom dynamics.

Technology in Science Education: From Tools to AI

The history of science education is intricately linked to the advancement of classroom technologies, which have progressively broadened the pedagogical options accessible to educators. During the mid-twentieth century, technologies including overhead projectors, slide presentations, and audiovisual media were progressively integrated into primary and secondary classrooms, enabling educators to illustrate scientific concepts more effectively. These initial tools functioned mainly as adjuncts to conventional instruction, emphasizing the importance of the educator and the textbook. With the emergence of the digital era in the late twentieth and early twenty-first centuries, technology adopted a more transformative function. Computers, interactive whiteboards, and internet-enabled resources facilitated students' independent access to scientific information, engagement with simulations, and participation in online learning communities (Cuban, 2001; Selwyn, 2011).

The advancement of educational software and online platforms has markedly transformed the pedagogical landscape by fostering inquiry-based and student-centered methodologies. In science education, simulation tools like PhET interactive simulations allowed students to investigate phenomena that were either excessively complex or impractical to replicate in classroom laboratories (Perkins et al., 2006). The subsequent advent of digital learning management systems and blended learning models further enhanced access to scientific content, facilitating differentiated instruction and self-paced learning (Garrison & Vaughan, 2008). Nevertheless, despite these advancements, challenges remained, especially in primary schools where insufficient resources and teacher proficiency frequently hindered the effective implementation of technology (Harlen, 2010).

The latest phase in this progression is characterized by the incorporation of Artificial Intelligence (AI), specifically large language models (LLMs) like ChatGPT. In contrast to previous educational technologies that mainly focused on presenting or organizing information, ChatGPT signifies a transformative shift towards interactive, adaptive, and dialogic learning. Engaging students in real-time discussions aligns with the pedagogical principles of inquiry and dialogue fundamental to science education. Research demonstrates that generative AI tools can facilitate personalized learning by tailoring explanations to individual student requirements, scaffolding inquiry processes, and producing resources like worksheets or experimental prompts (Kotsis, 2024c; Kotsis, 2024d). Thus, ChatGPT functions not merely as a technological instrument but also as an educational ally, enhancing teachers' ability to involve students in significant scientific inquiry.

This evolution also underscores the global disparities in technology integration. In certain nations, AI has been integrated into digital innovation strategies, whereas in others, systemic challenges like overcrowded classrooms, inadequate infrastructure, and insufficient teacher training have hindered its implementation. Research from Pakistan demonstrates the potential and challenges of ChatGPT in education, emphasizing its ability to alleviate teacher shortages and foster active learning, while also

acknowledging obstacles related to digital literacy and infrastructure (Sain & Chansa, 2023). Likewise, research in Namibia highlights that the incorporation of AI in rural educational institutions is significantly contingent upon resource availability and teacher readiness (Elifas & Simuja, 2024). These findings indicate that although ChatGPT signifies a significant advancement in educational technology, its equitable implementation necessitates meticulous consideration of contextual elements, such as national policy frameworks, teacher development, and infrastructural investment.

The progression from overhead projectors to AI-driven conversational agents illustrates that technology in science education is dynamic and perpetually advancing. ChatGPT exemplifies the most recent advancement in a historical continuum of tools that have progressively transitioned the emphasis of education from the mere transmission of knowledge to the facilitation of inquiry and the construction of understanding. The ability to function as both a resource generator and a dialogic partner indicates a new era in science pedagogy, which aims to close enduring disparities in primary education, while concurrently introducing new inquiries regarding equity, ethics, and the role of educators in an AI-enhanced classroom.

Pedagogical Opportunities with ChatGPT

The integration of ChatGPT into primary science education offers a distinctive opportunity to transform children's interaction with scientific concepts. In contrast to conventional digital tools that mainly serve as information repositories or content delivery platforms, ChatGPT provides dialogic interaction, adaptive scaffolding, and the ability to produce context-specific resources. These attributes render it especially beneficial in tackling enduring issues in science education, including minimal student engagement, challenges in comprehending abstract concepts, and the necessity to cater to varied learning styles.

ChatGPT's most notable contribution is its ability to customize learning experiences. In science education, where students frequently possess diverse levels of prior knowledge and varying rates of comprehension, individualized support is crucial for enhancing understanding (Tomlinson, 2014). ChatGPT offers prompt, customized feedback specific to each learner's inquiries, enabling students to pursue questions without apprehension of failure. This is particularly pertinent in intricate fields like physics, where misconceptions are prevalent and challenging to rectify via conventional teaching methods (Driver et al., 1994; Kotsis & Tsiouri, 2024). Studies demonstrate that AI-powered tools can assist in recognizing and rectifying misconceptions by providing various explanations and facilitating learners through a process of iterative questioning (Kotsis, 2024a; Jayasinghe, 2024).

Besides personalization, ChatGPT fosters engagement by facilitating inquiry-based and project-based learning. These pedagogies, well-established in science education, prioritize the active construction of knowledge via experimentation, inquiry, and collaboration (Hmelo-Silver et al., 2007; Vakarou et al., 2024; Kotsis, 2024e). AI integration has demonstrated the capacity to enhance these methodologies by promoting problem-solving discussions and providing support during intricate tasks (Gong et al., 2024; Kotsis, 2025)). In project-based contexts, ChatGPT can assist students in designing experiments, formulating hypotheses, and analyzing data, thereby enhancing the inquiry cycle beyond the feasible support that teachers can provide to each individual. This capability fosters critical thinking and promotes collaborative exploration, enabling students to collectively enhance their ideas with the assistance of a real-time AI tool.

ChatGPT's versatility enables it to meet the requirements of various learners. AI can provide simplified explanations, alternative representations like analogies, and adapt to preferred engagement methods for students with learning difficulties or those needing special educational support (Drossinou-Korea & Alexopoulos, 2024; Kotsis, 2023). By accommodating various modalities—visual, auditory, and textual—ChatGPT diminishes participation barriers and fosters inclusive science education. This adaptability is crucial as it corresponds with the principles of Universal Design for Learning (UDL), which advocate for flexible teaching methods to cater to diverse learners (Meyer et al., 2014).

Furthermore, ChatGPT facilitates pedagogical innovation through its integration with flipped and blended learning methodologies. In flipped models, students utilize ChatGPT outside the classroom to prepare for lessons through exploratory discussions on scientific phenomena, while class time is

allocated for collaborative experimentation and reflection. Alan and Yurt (2024) established that ChatGPT-enhanced flipped learning promotes active engagement and deeper understanding, resulting in students being better prepared for inquiry upon arriving at lessons. This signifies a pedagogical transition from teacher-centered instruction to student-centered inquiry, aligning with modern science education reforms that prioritize inquiry and problem-solving skills as essential outcomes (Bybee, 2013).

Collectively, these opportunities demonstrate the transformative impact that ChatGPT can have in primary science classrooms. Its dialogic and adaptive capabilities closely align with constructivist and inquiry-based principles, while its versatility guarantees support for diverse learners in their engagement with science. Nonetheless, actualizing this potential necessitates that educators are trained not only to embrace ChatGPT as a novelty but to incorporate it judiciously into cohesive pedagogical frameworks. Only then can the complete range of opportunities for personalization, inquiry, and inclusivity be actualized in manners that augment scientific literacy and equip students for the exigencies of a swiftly evolving world.

Challenges for Teachers and Classrooms

The incorporation of ChatGPT into primary science education offers significant potential, yet it also introduces various pedagogical, ethical, and practical challenges that require thorough scrutiny. A primary challenge is the significant disparity in digital literacy levels among educators and learners. Numerous primary school educators, especially in under-resourced or rural settings, receive inadequate training in advanced technologies like generative AI, resulting in ambiguity regarding the effective incorporation of these tools into lesson planning and classroom practices (Pizà-Mir & Saz-Pérez, 2024). The absence of familiarity threatens to diminish ChatGPT to a mere novelty instead of an integral educational tool, potentially worsening the disparities between schools with proficient educators and those lacking such expertise. Variations in digital competencies among students result in unequal preparedness to engage with AI-driven instruction, potentially leading to disparities in access to quality science education (Baule et al., 2024).

A notable challenge pertains to the ethical ramifications of employing generative AI in elementary classrooms. Large language models lack neutrality; they assimilate biases from their training data and may unintentionally perpetuate stereotypes or inaccuracies (FattahiBavandpour, 2024). Primary students, being particularly impressionable, face risks from exposure to biased or misleading content that necessitates careful mitigation through teacher oversight. Furthermore, the implementation of AI in education prompts concerns regarding data privacy, especially when students' interactions with the tool are recorded or scrutinized. Protecting student data is a critical concern, as emphasized by researchers advocating for comprehensive frameworks for responsible AI implementation in educational institutions (Almasri et al., 2024). In the absence of explicit policies, educators may inadvertently undermine children's digital rights while striving for pedagogical innovation.

The issue of excessive dependence on AI complicates its implementation in educational settings. Students relying on ChatGPT for instant responses risks undermining critical thinking and problem-solving skills, which are fundamental objectives of science education (Petrassi, 2024). Although AI can facilitate inquiry-based learning, its implementation must be meticulously regulated to guarantee that students actively engage in knowledge construction rather than merely receiving machine-generated explanations passively. This equilibrium necessitates meticulous instructional design, wherein AI is integrated as an aid rather than a replacement for genuine involvement in scientific inquiry.

Furthermore, the pragmatic aspects of classroom management must not be disregarded. Educators are accountable for not only imparting knowledge but also for managing social interactions, overseeing student participation, and adjusting instruction instantaneously. The implementation of ChatGPT introduces additional complexity, necessitating educators to oversee both human and machine interactions. In overcrowded classrooms, particularly in contexts like Pakistan, the implementation of AI has been suggested as a partial remedy for teacher shortages; however, the responsibility for ensuring meaningful and equitable utilization still rests with the teacher (Sain & Chansa, 2023). This highlights the importance of incorporating AI integration into comprehensive professional development and systemic support frameworks.

Ultimately, infrastructure and access challenges persist as urgent issues. The effective deployment of ChatGPT necessitates dependable internet access, adequate devices, and conducive educational policies. In numerous areas, these conditions are not assured, resulting in inconsistent implementation and perpetuating educational disparities (Elifas & Simuja, 2024). Therefore, although the educational potential of ChatGPT is significant, its advantages will only be actualized if these structural and contextual impediments are explicitly confronted.

The challenges of integrating ChatGPT into primary science classrooms pertain to three interconnected areas: teacher preparedness and digital literacy, ethical and pedagogical issues, and infrastructural limitations. Resolving these issues necessitates a multi-faceted strategy encompassing educator training, policy direction, and institutional investment, guaranteeing that AI augments rather than detracts from the objectives of science education.

Curriculum and Teacher Development

The effective incorporation of ChatGPT into primary science education necessitates a focus on curriculum development and teacher professional advancement. At the curriculum level, ChatGPT facilitates inquiry-based learning by producing interactive worksheets, assisting in the design of hands-on experiments, and generating differentiated resources tailored to various student requirements. Prior studies indicate that generative AI can facilitate the design of economical experiments, create accessible instructional materials for students, and connect abstract ideas with practical activities, thus enhancing access to experiential science in resource-limited environments (Abrahams & Millar, 2008; Kotsis, 2024c; Kotsis, 2024d). ChatGPT promotes interdisciplinary methodologies by assisting educators in integrating science within wider STEM and sustainability frameworks, exemplified by scenario-based tasks that link energy consumption, climate change, and practical problem-solving (Bybee, 2013).

Simultaneously, curriculum innovation necessitates systematic professional development for educators. Educators require not only technical proficiency with AI tools but also pedagogical strategies to align ChatGPT outputs with educational objectives and ethical standards. Recent findings indicate that pre-service teachers acknowledge AI's value but express hesitations regarding training, assessment reliability, and ethical use (Panagou et al., 2025). Professional development programs must encompass digital literacy, instructional design, and concerns regarding data privacy and inclusivity (Pizà-Mir & Saz-Pérez, 2024). Collaborative communities of practice, in which educators exchange instances of AI-enhanced lessons and contemplate challenges, have demonstrated efficacy in reinforcing adoption and averting superficial utilization of the technology (Santos & Villan, 2023). Moreover, continuous feedback systems, both technological and peer-based, are crucial for assisting educators in enhancing their methodologies and maintaining innovation (Byers, 2024).

By merging curriculum reform with ongoing teacher development, ChatGPT can be regarded not as a replacement for pedagogy but as a facilitator of innovative, inquiry-driven science education. It is essential to ensure that educators are confident, ethically informed, and supported at institutional levels to unlock the transformative potential of AI in primary science classrooms.

Global Perspectives and Future Outlook

The incorporation of ChatGPT into primary science education should be considered from a global standpoint, as the advantages and limitations of AI implementation differ markedly across various contexts. In high-income nations, robust digital infrastructures, teacher training programs, and curricular adaptability enable ChatGPT to augment inquiry-based pedagogies, improve differentiation, and broaden the application of experimental and interdisciplinary learning. In these contexts, educators are more inclined to utilize AI as a collaborative partner in lesson design, integrating it into flipped learning models, virtual laboratories, and project-based initiatives (Alan & Yurt, 2024; Radianti et al., 2020). Nonetheless, even in well-funded systems, issues of inclusivity persist, especially concerning equitable access for students from underprivileged backgrounds or those with special educational needs (Drossinou-Korea & Alexopoulos, 2024).

In low- and middle-income nations, structural impediments, including unequal access to electricity, internet, and digital devices, present significant challenges. Research from Pakistan and Namibia suggests that ChatGPT may enhance overcrowded classrooms and facilitate personalized learning;

however, these advantages depend on sufficient infrastructure and ongoing teacher assistance (Sain & Chansa, 2023; Elifas & Simuja, 2024). In the absence of systemic investment, the adoption of AI is likely to exacerbate existing inequalities instead of mitigating them. Addressing these challenges necessitates policy frameworks that connect technological innovation with inclusive educational advancement.

The prospects of ChatGPT transcend mere resource provision. Its ability to facilitate inquiry, create problem-based scenarios, and promote interdisciplinary collaboration indicates that it may play a pivotal role in fostering creativity and scientific reasoning among young learners (Gong et al., 2024; Bybee, 2013). Moreover, when integrated with immersive technologies like virtual and augmented reality, ChatGPT has the potential to democratize access to advanced simulations and laboratory experiences (Radianti et al., 2020). However, these advancements must be accompanied by stringent ethical protections. Concerns regarding data privacy, transparency, and algorithmic bias highlight the necessity for explicit institutional guidelines for responsible utilization (FattahiBavandpour, 2024).

The future of ChatGPT in science education will significantly rely on the effective convergence of teacher professional development, infrastructure investment, and policy support to ensure equitable implementation. When integrated responsibly, ChatGPT can serve as a catalyst for rethinking science education, addressing global disparities, and equipping learners to confront the scientific and ethical challenges of the twenty-first century.

Conclusion

The incorporation of ChatGPT into primary science education should be considered from a global standpoint, as the advantages and limitations of AI implementation differ markedly across various contexts. In high-income nations, robust digital infrastructures, teacher training programs, and curricular adaptability enable ChatGPT to augment inquiry-based pedagogies, improve differentiation, and broaden the application of experimental and interdisciplinary learning. In these contexts, educators are more inclined to utilize AI as a collaborative partner in lesson design, integrating it into flipped learning models, virtual laboratories, and project-based initiatives (Alan & Yurt, 2024; Radianti et al., 2020). Nonetheless, even in well-funded systems, issues of inclusivity persist, especially concerning equitable access for students from underprivileged backgrounds or those with special educational needs (Drossinou-Korea & Alexopoulos, 2024).

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Use of Virtual Reality Applications in Teaching Safety Skills to Individuals with Special Needs: A Literature Review

Veli Emre Kurtça[1] Zülal Engin[2] Evren Günaydın[3]

Abstract

The aim of this study is to examine the impact of Virtual Reality (VR) applications used in teaching safety skills to individuals diagnosed with Intellectual Disability (ID) and Autism Spectrum Disorder (ASD) within the national and international literature. Numerous safety skills have been developed to address threats encountered in daily life (e.g., pedestrian safety, home safety) as well as other hazardous situations (e.g., fire safety, abduction prevention). In recent years, studies focusing on teaching safety skills to children and other vulnerable groups have increased, aiming to prevent injuries, accidents, and other negative outcomes associated with insufficient safety skills. In this context, research addressing the teaching of safety skills was reviewed. This study includes articles published between 2000 and 2025 in national and international peer-reviewed journals.

The inclusion criteria were as follows: participants diagnosed with ID and/or ASD; publication in a peer-reviewed journal; use of any form of VR during the instructional process; and employment of an experimental or quasi-experimental research design. Articles meeting these criteria were identified through searches in the Social Science Citation Index, Science Citation Index, Institute of Education Science–ERIC, Academic Search Complete–EBSCO, and ULAKBIM-TR databases. The studies deemed eligible were examined in terms of the skills taught, participant characteristics, participant ages, research design, instructional materials used, type of VR, reliability data, and social validity. A total of 13 studies met the inclusion criteria.

The findings of this review provide important insights for researchers who aim to teach safety skills to individuals with special needs through VR-based applications.

Keywords: Special education, special needs, virtual reality, safety skills

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Introduction

Intellectual disability (ID) and autism spectrum disorder (ASD) are types of special needs that describe individuals who exhibit significant developmental differences from their peers (Ünlü, 2022). Intellectual disability is defined as the presence of substantial limitations in intellectual functioning and adaptive behavior, with these limitations emerging before the age of 22 (American Association on Intellectual and Developmental Disabilities [AAIIDD], 2021). Autism spectrum disorder, on the other hand, is a neurodevelopmental condition characterized by challenges in communication and social interaction, along with repetitive behaviors, sensory sensitivities, and restricted interests (American Psychological Association [APA], 2022). A diagnosis of ASD requires observable difficulties in at least two domains—social communication and behavioral patterns (APA, 2022).

Individuals with these disabilities may experience difficulties in recognizing and naming dangerous situations, protecting themselves when confronted with danger, and communicating the need for help to others. Such limitations hinder their ability to increase independence and maintain personal safety. For this reason, it is essential to provide opportunities to teach safety skills to individuals with special needs—both within educational programs and in daily life (Ergenekon & Çolak, 2019).

Individuals with special needs face a higher risk of safety threats arising from both the physical environment and other people, primarily because they may experience limitations in recognizing danger, understanding how to respond to threats, and engaging in avoidance behaviors compared to their typically developing peers (Miltenberger & Novotny, 2022). Safety skills encompass a wide range of subdomains, including injury prevention (minor and major injuries), first aid skills, pedestrian skills, self-protection skills (such as recognizing and responding to abuse or bullying), fire and disaster safety skills, emergency phone use, wayfinding skills (reporting one's location and navigating safely when lost), social safety skills (avoiding strangers and abduction), driving skills, reading and responding appropriately to product labels, travel skills, and behaviors that help prevent self-harm (Kıyak et al., 2019; Ergenekon & Çolak, 2019; Miltenberger & Novotny, 2022). The literature indicates that individuals with special needs encounter safety threats at a rate two to three times higher than their typically developing peers, and they are particularly vulnerable in detecting and reporting instances of abuse (Sarı & Girli, 2012; Çelik, 2014; Bulut & Karaman, 2018; Büber et al., 2023; Özçevik-Subaşı, 2023). This heightened vulnerability underscores that teaching safety skills to individuals with special needs is not only an educational necessity but also a critical component of protecting their physical integrity and fundamental right to safety.

Literature Review

The literature presents various instructional methods used to teach safety skills to individuals with intellectual disabilities or autism spectrum disorder. These methods include social story instruction, power card strategies, video modeling, behavioral skills training, direct instruction, constant time delay, progressive time delay, most-to-least prompting, least-to-most prompting, simultaneous prompting, modeling, behavioral intervention approaches, instruction using examples and non-examples, literacy-based behavioral interventions, role-playing, computer-based instruction, and parent coaching (Kıyak et al., 2019; Ergenekon & Çolak, 2019; Erol & Aktan, 2024). Research also demonstrates that instructional technologies and supportive technological tools—particularly virtual reality (VR) applications—have been incorporated into teaching safety skills (Ergenekon & Çolak, 2019).Virtual reality (VR) technology enables individuals to interact with a non-physical environment through various hardware and software components, creating the sensation of being present in a virtual world without constraints of time or place by integrating visual, auditory, and other sensory stimuli (Çelikan, 2022; Kahveci & Sondaş, 2022; Sancar & Atal, 2023). Offering a modern perspective beyond traditional educational approaches, VR allows learners to engage directly with the environment, sustain attention, practice tasks with narrative flexibility, gain hands-on experience with virtual objects, and activate multiple sensory channels (Cavaş et al., 2004). To achieve this, VR employs a range of devices, including head-mounted displays (HMDs), mobile-based VR headsets, and standalone VR headsets such as the Oculus Quest, which contain their

own processing components. Additional tools include data gloves for object interaction; controllers or joysticks equipped with sensors that track hand position, movement, and intended actions; cabin simulators replicating real-world settings; chamber-style rooms where 3D visuals are projected; base stations that track users' location, height, and movements via infrared signals; body-worn tracking systems that transmit motion into the virtual environment; and facial-tracking systems that map the user's expressions onto virtual avatars (Cavaş et al., 2004; Geriş, 2021). VR environments also vary depending on their purpose, level of immersion, and materials used. Common types include immersive virtual reality, augmented reality, window/desktop-based VR, mirror worlds, Waldo-style environments, customized VR rooms, cabin simulators, cyberspace platforms, telepresence systems, and dome-based projection environments (Kurtça, 2021).

The literature highlights several advantages of virtual reality in educational settings, *including: (a) enabling learners to experience environments that are difficult or costly to access in the real world, or to engage safely in activities that might otherwise be dangerous; (b) providing instructional contexts in which learners can participate more actively rather than relying solely on observational learning; (c) offering consistent representations of real-world environments and situations; (d) delivering immediate and consistent feedback; and (e) allowing the development of learning environments and activities tailored to users'* needs and individual characteristics (Özdemir et al., 2019). When VR applications are designed in line with universal design principles, they offer numerous opportunities for repeated practice, enabling individuals with special needs to learn at their own pace (Özdemir et al., 2019).

The literature indicates that studies focusing on the use of virtual reality to teach safety skills to individuals with special needs remain limited. Therefore, the present study is expected to contribute valuable information to this field. The aim of this study is to qualitatively analyze single-subject research on teaching safety skills to individuals with special needs, published between 2000 and 2025 in national and international peer-reviewed journals, based on their demographic and methodological characteristics. In the studies deemed eligible, the following variables were examined:

- the skill being taught,
- the participants,
- the ages of the participants,
- the research model/design,
- the materials used,
- the type of virtual reality applied,
- reliability data and social validity

Method

In this study, a systematic literature review was conducted by examining research that employed experimental or quasi-experimental designs to teach safety skills to individuals with intellectual disabilities or autism spectrum disorder. The review covers articles published between 2000 and 2025 in national and international peer-reviewed journals. The inclusion criteria were as follows: participants diagnosed with ID and/or ASD; instruction focused on teaching safety skills to individuals with special needs (specifically those with intellectual disabilities or ASD); the use of any type of virtual reality during the instructional process; publication in a peer-reviewed journal; and the implementation of an experimental or quasi-experimental research design.

Articles published between 2000 and 2025 in national and international peer-reviewed journals were searched using the Social Science Citation Index, Science Citation Index, Institute of Education Science–ERIC, Academic Search Complete–EBSCO, and ULAKBİM-TR databases. The keywords used during the search included special education, special needs, safety skills, autism, intellectual disability, and virtual reality. These terms were combined in various ways with the expression "individuals with special needs" to conduct a comprehensive electronic search. The initial search yielded 30 studies. After applying the inclusion criteria, a total of 13 studies published between 2000 and 2025 met the eligibility requirements. Of these studies, six employed quasi-experimental designs, three used between-group experimental designs, one utilized a group experimental design, and three were single-subject studies. For each of the 13 included studies, data were extracted on the skill taught, participant

characteristics, participants' ages, research model/design, instructional materials, type of virtual reality used, reliability data, and social validity. The extracted data are presented in **Table 1**.

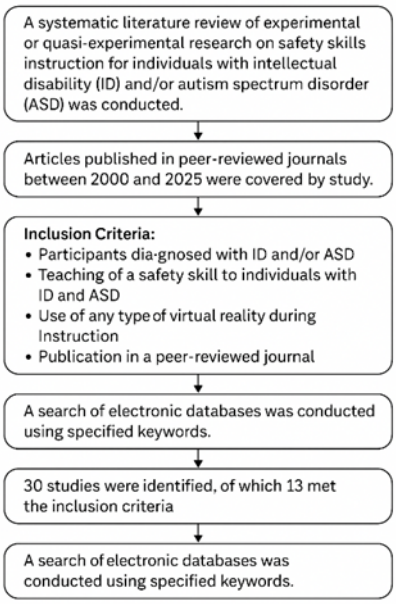


Figure 1. method and exclusion criteria

Findings

The findings of the 13 studies reviewed in this research indicate that virtual reality applications are most commonly used to teach pedestrian safety skills (such as crossing the street, understanding traffic lights, and recognizing road signs) and driving skills. The majority of participants across these studies were children, adolescents, and young adults with autism spectrum disorder, although a smaller number of studies included individuals with intellectual disabilities. Among the VR technologies employed, immersive VR and cabin simulators were used most frequently, while desktop VR and augmented reality were less commonly preferred.

In single-subject designs, interobserver agreement and procedural reliability were generally reported; however, these measures were often absent in group experimental studies. Overall, the findings suggest that virtual reality facilitates learning by enabling safe simulation of high-risk situations. At the same time, the existing body of research demonstrates limited methodological diversity and frequently lacks systematic reporting of social validity data.

Table 1.

Effectiveness Findings of Studies on Teaching Safety Skills Through Virtual Reality Applications

	Number of Participants / Diagnosis / Age / Gender	Skill	Research Model/Design	Materials	Type of Virtual Reality	Interobserver Agreement	Procedural Reliability	Social Validity
Kurtça & Gezgin (2023) *Effectiveness of virtual reality technology in teaching pedestrian skills to children with intellectual disabilities*	3/ID/11-15/M(1), F(2)	Pedestrian skills (street crossing)	Single-subject research – multiple probe across participants	Bobo VR Z4 ve Bobo VR Z5	Immersive virtual reality	+	+	+
Mengue & Topio (2011) *The use of virtual reality in teaching safety skills to children with ASD. Journal of Autism and Developmental Disorders*	18/ID/18/TD/ 18-38/ M(24), F(12)	Wayfinding and shortcut use	Experimental design with between-group comparisons	Desktop virtual reality; mouse, keyboard, joystick	Window/Desktop virtual reality	-	-	-
Patrik et al. (2020) *Executive function "drives" differences in simulated driving performance between young adults with and without autism spectrum disorder*	48/ASD/48/TD/ 16-26	Driving skills	Experimental design with between-group comparisons	Steering wheel, gas–brake pedal, screen	Cabin simulator	-	-	-
Josman et al. (2008) *Effectiveness of virtual reality for teaching street-crossing skills to children and adolescents with autism*	6/ASD/6/TD /8-16/ M(10), F(2)	Street crossing	Experimental design with between-group comparisons	Pentium 3 (1.2 MHz) desktop computer, 17-inch LCD monitor	Window/Desktop virtual reality	+	-	-
Dixon et al. (2019) *A program evaluation of skill acquisition and adaptive behavior changes in a large community-based autism center*	3/ASD/4-6-10-/ M(1), F(2)	Road safety (crosswalk use, traffic lights, awareness of vehicles)	Single-subject research	Oculus Rift (CV1) VR headset, Samsung Gear 360 camera	Immersive virtual reality	+	+	-

Saiano et al. (2025) *Natural interfaces and virtual environments for the acquisition of street crossing and path following skills in adults with Autism Spectrum Disorders: A feasibility study*	7/ASD/19-44/ M(7)0	Street crossing with or without traffic lights and following road signs	Single-subject research	Mouse, keyboard, markerless motion-capture device (Microsoft Kinect)	Window/Desktop virtual reality	+	+	-
Cox et al. (2017) *Driving simulation performance in teens with ADHD, autism spectrum disorder, and controls: An exploratory analysis*	51 (ASD)- Mean ages:25= 17,83, 26=18,08/M	Driving skills	Group experimental design	Driver Guidance System (DGS-78) VR driving simulator	Cabin simulator	+	+	+
Zhang et al. (2017) *Cognitive load measurement in a virtual reality-based driving system for autism intervention.*	20 (ASD)	Driving skills	Quasi-experimental design	Logitech G27 steering wheel set	Cabin simulator	+	+	+
Bian et al. (2019) *A multimodal VR-based driving system for autism intervention*	23/(ASD)/M(21) F(2)	Driver training, traffic rules	Quasi-experimental design	Computer, LCD monitor, gaming seat, Logitech G27 steering wheel set	Window/Desktop virtual reality	+	+	+
Miller et al. 2020 *Virtual reality air travel training using Apple iPhone X and Google Cardboard: A feasibility report with autistic adolescents and adults*	5/(ASD)/4-8/M(4),F(1)	Air travel training	Quasi-experimental design	Phone X and a 7-dollar Google Cardboard, airport-themed materials (prop objects, photographs)	Immersive virtual reality	-	-	+
Miller et al. (20219) *Evaluating a video-based parent training program for teaching play skills to children with autism*	7/ASD	Air travel training	Quasi-experimental design	iPhone X® ve Google Cardboard	Immersive virtual reality	-	-	+

Ross et al. (2017) *Measuring the attitudes of novice drivers with autism spectrum disorder as an indication of apprehensive driving*	66/ (ASD)/ M(66)	Driving attitude – anxiety related to driving	Quasi-experimental design	Vehicle simulator	Cabin simulator	-	-	+
Nomicos et al. (2023) *Virtual reality intervention for pedestrian safety in autistic children*	3/ASD/8-14/F(3)	Street-crossing skill	Single-subject research – multiple probe design across participants	VR headset, video, and photographs	Augmented virtual reality	+	+	+

Abbreviations: M: Male, F: Female, ID: Intellectual Disability, ASD: Autism Spectrum Disorder, TD: Typically developing

Conclusion

This review demonstrates that virtual reality can produce clear and observable behavior changes in the teaching of safety skills. For example, Kurtça and Gezgin (2023) reported that pedestrian street-crossing responses increased systematically across sessions when immersive VR was used. Similarly, Dixon et al. (2019) showed that children displayed faster and more accurate stop–go responses to traffic lights during VR sessions. A similar pattern is evident in driving-related studies; Cox et al. (2017) and Zhang et al. (2017) reported that target driving behaviors were exhibited with greater control and that error rates were reduced within VR simulations. These findings suggest that VR serves as a powerful tool for shaping behavior, reducing errors, and providing safe opportunities for repeated practice. However, several methodological limitations warrant attention. In some studies, social validity or procedural reliability data were not reported, creating uncertainty about the sustainability of the observed behavior changes and the extent to which they generalize to real-world settings. Additionally, studies utilizing desktop-based VR often lacked reliability measures, making it difficult to evaluate behavioral rigor.

Overall, VR applications provide an effective environment for reinforcing and modeling target safety behaviors; however, there remains a need for stronger research designs, systematically reported reliability data, and clear indicators of social validity. Addressing these gaps will enhance the potential of VR to produce more comprehensive and lasting behavior changes in the safety skills of individuals with special needs.

Future research should include experimental studies that compare different types of VR, incorporate larger sample sizes, and examine long-term follow-up outcomes. In addition, systematically investigating factors such as family involvement, transfer of learning to real-world settings, and user experience will strengthen the applicability and effectiveness of VR-based safety instruction. Overall, the findings indicate that VR technology holds strong potential for supporting independence and safety skills in individuals with special needs.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Institutional Review Board Statement: This study is a systematic review and did not involve the collection of new data from human participants. Therefore, ethical approval from an institutional review board was not required.

Data Availability Statement: This study is a systematic review and does not involve the collection or analysis of primary data. Therefore, no datasets were generated or analyzed during the research. All sources included in the review are publicly available in the scholarly databases cited within the manuscript.

Conflict of Interest: All authors must disclose any financial, personal, or institutional relationships that could influence or create a potential bias in their work. If no such conflicts exist, authors should explicitly state that there is no conflict of interest.

Generative Artificial Intelligence Statement: In this study, generative artificial intelligence tools were used solely for translation, proofreading, and the preparation of figures. No AI tools were utilized for data analysis, interpretation, or the development of the manuscript's scientific content. The authors affirm that they take full responsibility for the accuracy, integrity, and originality of all findings and interpretations presented in the manuscript.

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Learning By Using Smart Technologies

Suzana A. Nikodinovska Bancotovska [1]

Abstract

The problem studied in this paper is the result of a theoretical examination of the possibilities of smart technologies in modern teaching. The environment for learning and development should be appropriately stimulated. Stimulation, among other things, refers to the creation of conditions and situations that encourage the individual who learns and acts motivating.

The theoretical analysis focuses on how the computer represents a combination of various earlier technological advancements. It also examines how modern devices like smartphones (which function as mini-computers), tablets, and smart TVs now perform many of the tasks that were traditionally done by computers.

To be clearly, hypermedia refers to a medium of information that combines various forms of content such as text, images, audio, video, animations, and hyperlinks. It allows users to interact with and navigate through information in a dynamic and flexible way.

The purpose of this research is to explore how the use of multimedia - such as multimedia data, applications, and documents - through smart technologies affects modern teaching and learning processes.

The target population of the study consists of primary education students. In order to prepare students, as future teachers, to effectively stimulate learning through the use of smart technologies, we incorporated these technologies into the instructional process during their education. For this category of students, we have defined a set of strategies for implementing hypermedia-based stimulation aimed at supporting learning and development. These strategies are tailored to the specific educational level and the nature of the subject matter, as the application of hypermedia stimulation in the teaching process varies accordingly.

The significance of this problem stems from the need to study the impact of smart technologies on learning. Results will be relevant for creating adequate opportunities to realize modern, quality teaching with primary education students, by applying smart technologies. Teachers must be prepared to empower students with the advantages technology can bring. Schools and classrooms, both real and virtual, must learn teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills.

Keywords: smart technologies, stimulation, learning, development

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Introduction

The problem studied in this paper is the result of a theoretical examination of the possibilities of smart technologies in modern teaching. The subject of theoretical analysis is: the computer as the synthesis of several previous technological achievements, smartphones that with their characteristics are mini computers, tablets, and smart TVs that take over part of computer activities. In today's world, we need to gain new insights and open up new perspectives. Learning takes place in an institutionalized educational system, but also in natural as well as diversely organized conditions, depending on the type of learning. In this paper, we will focus on organized learning, which is a function of the acquisition of systematized knowledge.

The significance of this problem stems from the need to study the impact of smart technologies on learning. Results will be relevant for creating adequate opportunities to realize modern, quality teaching with primary education students, by applying smart technologies.

The complexity theory lens provides an appropriate framework to reason about the complexities that surface due to interactions of the elements of smart digital technologies in the education system. The complementary strength of the adopted methodological approach led to multiple discourses on technology-enabled and technology-enhanced learning environments (Mhlongo, Siyabonga et al. 2023).

Systematic introduction of the smart technologies in the teaching process will contribute for more efficient realization of the program goal and tasks. The teacher qualifies students independently to come to knowledge, enabling them for self education. By application of smart technologies students discover, think and seek for a solution. They are independent and innovative, leaving a huge space for individualized teaching (Kojčić, Z. 2012).

The implementation of smart technologies will give us an opportunity to reach the goals we talked about. Nevertheless, it should be pointed out that this application dimension is not simple at all. In fact, the implementation of smart technologies should be preceded by a series of activities and procedures. Part of them should be carried out before the implementation, that is, preliminary, whereas the rest of them should be carried out during the actual implementation, that is, continually.We define smart education as the “efective and coherent use of information and communication technologies to reach a learning outcome using a suitable pedagogical approach” (Demir, K.A. 2021). Implementation of smart technologies in the educational process is generally done in two modes: In the classroom, through guided teaching and independently, through individual activity.

Literature Review

Necessity of stimulation for learning

For proper development, which will result in a psychologically healthy individual, it is necessary to create the right conditions. An individual's development is conditioned by a series of factors, which differ in nature, origin, mode of action, and organizational consistency.

The environment for learning and development should be appropriately stimulated. Therefore, the conditions in which learning takes place should not have an elemental dimension. On the contrary, stimulating learning should be understood as a necessity on which the effects of learning directly depend.

Creating conditions for learning and development should result in effectiveness in the social, intellectual, physical and emotional spheres. This should be appropriate to the age and individual level of development.

Stimulation refers to the creation of conditions and situations that encourage the learner to act and act motivationally. There are many ways and opportunities to create a stimulating environment for learning and development. Stimulation for learning can and should be the most diverse. Diversity is often based on: the goals to which they are striving and the interests and needs of the target group.

It is very important for the teacher to create an environment and atmosphere in the classroom where students feel free to express their own opinions, to believe in themselves, in the teacher and in their friends, to use various methods to impart knowledge to students, to involve them in making decisions, to encourage them to cooperate, respect others, and be successful. The introduction of digital

technologies into the learning environment has resulted in a paradigm shift that has transformed the education sector for the better. These technologies are broadly used by both teachers and learners to provide new learning experiences within the classroom and beyond (Mhlongo, Siyabonga et al. 2023).

Media stimulations

Today, in the age of computerization and the unlimited possibilities of the Internet, it is much more important for the student to learn how to learn and come up with information than memorize facts that the teacher has said. It's also very important for every student to enable them to develop their own potential.

The media attracts and retains the attention of consumers. In addition to being a source of information, communication and entertainment, they open up new possibilities for virtual perception of reality in every way.

The computer as a unity of multiple media occupies the leisure time of young people and, increasingly, children. The problems of consumption observed from the perspective of duration, frequency, and selectivity open up new dimensions in thinking about how to properly utilize the true values of a computer, without negative consequences. Selective and timely access to the informational and cognitive values emanating from the Internet-connected computer are issues that should be considered by anyone involved in educational impacts on children and youth. This is primarily about parents, educators, and teachers. It is also undeniable the influence of one's own consciousness.

Multimedia, primarily interpreted as a combination of digital and analogue devices (computers, audio devices, video cameras) in recent times, has changed its dimension due to the influx of technological advances, changing its dimension. The emphasis is on digital integration and complementarity of text, audio, video, graphics, image, animation, because in this way the individual can play an interactive role in the process of using the benefits of multimedia. Applied to teaching, multimedia allows for new instructional experiences, new stimuli, and new roles for teacher and student. The student finds himself in a new situation, in which he establishes an interaction with the content he perceives. That situation motivates and stimulates him, and he is ready to face the teaching material in a close and interesting way. The teacher sets situations and conditions, coordinates and regulates. It is not in the foreground, but creates learning incentives with technical support.

Multimedia and its applications are always related to multimedia data, multimedia applications, and multimedia documents. Hyperlinks and hypertext are essential for the correct and timely transmission of information to its user, in our case the student. Multimedia applied in teaching and learning in general allows for the display, transmission, processing, and transformation of multimedia data, content, facts, and situations.

At the organizational and system levels, smart technologies also hold promise in making education more effective (Vincent-Lancrin, S. 2022). We usually ask ourselves: “Will the educational processes be different, with more automated or computer-based tasks throughout the learning process? ”

Method

The problem studied in this paper is the result of a theoretical examination of the possibilities of smart technologies in modern teaching.

The subject of theoretical analysis is:

•The computer as the synthesis of several previous technological achievements, smartphones that with their characteristics are mini computers, tablets, and smart TVs that take over part of computer activities.

•The purpose of the research concerns determining the effects of modern teaching from the application of multimedia, multimedia data, multimedia applications, and multimedia documents through smart technologies

•The population for which the study reflects is primary education students.

For this category of students we determine a package of strategies for the application of this type of stimulation for learning and development, because strategies for applying hypermedia stimulation in

the teaching process are specific, depending on the degree of education and the specifics of teaching matter.

Stimulation, among other things, refers to the creation of conditions and situations that encourage the individual who learns and acts motivating.

Findings

In order to enable the students - future teachers to apply the learning stimulation to the students with smart technologies, we have applied smart technologies in the teaching work with the students. In this way, we enabled the students to master the teaching contents more easily. But we've also empowered and encouraged them when they're teachers with students to apply appropriate stimulus tools for learning.

•In the theoretical elaboration of the relevant matter and in the application of smart technologies in the work with students, we concluded that there are several ways and opportunities to create a stimulating environment for learning and development:

•Learning stimulation can and should be most diverse;

•Diversity is usually depending on: the goals to which both the interests and needs of the target group are weighed;

•Today, in an era of computerization and unlimited internet capabilities, it is much more important for the student to learn how to learn and get information than to memorize facts that the teacher said;

•It is very important that the teacher creates an environment and atmosphere in the classroom where students will feel free to express their own opinion, believe in themselves

•Applied in teaching, multimedia provides new teaching studies, new stimulations and new roles for the teacher and student;

•The student is in a new situation, in which he establishes an interaction with the content he adopts;

•That situation motivates and stimulates him and he is ready to face the teaching matter in a close and interesting way;

•The teacher sets situations and conditions, coordinates and regulates. It is not in the foreground, but creates incentives for learning with technical support;

•Multimedia applied in teaching and in general in the learning process allows you to display, transmit, process and transform multimedia data, content, facts, and situations;

•Multimedia and its application are always associated with multimedia data, multimedia applications, and multimedia documents;

•Possible strategies for applying hypermedia stimulation in the teaching process are specific depending on the degree of education and the specifics of the teaching matter whose processing will be supported in this way;

•The expected effects of hypermedia stimulation go in the direction of increased interest, dynamism, activity, thought engagement, and the possibility of receiving feedback.

The significance of this problem stems from the need to study the impact of smart technologies on learning. Results will be relevant for creating adequate opportunities to realize modern, quality teaching with primary education students, by applying smart technologies.

Teachers must be prepared to empower students with the advantages technology can bring. Schools and classrooms, both real and virtual, must learn teachers who are equipped with technology resources and skills and who can effectively teach the necessary subject matter content while incorporating technology concepts and skills.

“Classroom analytics can also give feedback to teachers about how they could improve their teaching; specifically how and when to pay more attention to different groups of students in their class, based on their academic level, gender, ethnicity, and so on”..

Discussion, Conclusion, and Suggestions

The application of smart technologies in appropriate activities in working with students resulted in their greater activity, interest and motivation for work. Through hands-on activities, we simulated situations in which students would apply smart technologies in order to make teaching and learning more effective. The conclusions of this work are expected to improve the educational practice of applying smart technologies in the learning process. The learning and development environment should be properly stimulated. Therefore, the conditions in which learning occurs should not have a verse dimension. In doing so, the emphasis is placed on digital integration and complementarity of text, audio, video, graphics, image, animation, because in this way the individual can play an interactive role in the process of using the benefits of multimedia.

The recommendations relating to the stimulation of learning arising from this paper are as follows:

-Apply appropriate smart technologies in the learning and teaching process;

-Not to allow smart technologies to dominate teaching and learning;

-The role of the teacher must not be replaced by smart technologies;

-Smart technologies, i.e. the content displayed with them, should be age-appropriate for students;

-The application must be consistent with the teaching material being processed;

-Smart technologies to be applied with appropriate teaching methods and instructional forms;

-Smart technologies to function the development of the individual, not vice versa;

-The stimulating environment for the infusion should be supported by other types of stimulants;

-All of this should correspond to the age and individual degree of development of the individual.

To foster a stimulating learning environment with the help of smart technologies, we need to enable:

•Equipping the learning environment with the whole technical equipment, including the stabile Internet connection;

•Incorporation of the smart technologies in the teachers' initial education, as an educational content in different subjects and as a mode of work, thinking and communication in all school subjects;

•Appropriate curriculum changes, which means continual upgrading of the teachers' education for the new ways of smart technologies implementation;

•To take a positive attitude in the individual's consciousness toward the need for modernization of the educational process.

For better making a stimulating learning environment we propose the following model, where you have to:

•Understanding and accepting the benefits of using smart technologies;

•Knowledge and ability connected with smart technologies;

•Monitoring the current development in the field of smart technologies;

•Creation of adequate strategies for implementation of the smart technologies in the process of learning;

•Applying the technology for monitoring and evaluation of the studying and individual progress of the students (especially in the learning process).

The creation of learning and development conditions should result in effectiveness in the social, intellectual, physical and emotional spheres.

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ChatGPT-Based Vocabulary Instruction: Material Development, Vocabulary Acquisition, and the Support of Speaking Skills through the "News in 100 Seconds" Format

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Abstract

This paper examines how current video content can be effectively integrated into teaching German as a foreign language using the generative artificial intelligence tool ChatGPT and how this integration can enhance listening comprehension skills. As an illustrative example, short news videos produced by ARD under the title "News in 100 Seconds" are employed. These videos engage learners with current social developments, thereby increasing their interest in the course while simultaneously supporting listening comprehension and critical thinking skills.

The study directly utilises ChatGPT's capacity to generate news transcripts within a very short time. Transcripts that previously had to be produced manually by teaching staff through a time-intensive process can now be generated within seconds and adapted for various pedagogical purposes. Based on these transcripts, level-appropriate gap-fill exercises, targeted vocabulary lists, comprehension questions, and discussion prompts can be created efficiently. This significantly reduces teachers' workload and provides learners with diversified, level-appropriate learning opportunities. However, ChatGPT is not merely a time-saving tool; it also functions as a creative and versatile support in material development. Owing to its ability to generate content adaptable to different language levels, it facilitates personalised learning pathways and enhances flexibility in the teaching process. In addition, it enriches instruction by enabling the development of learner-specific materials and theme-based activities.

Although the "News in 100 Seconds" videos have been examined from various perspectives within the broader doctoral project, this paper specifically highlights ChatGPT's role in transcript generation and the development of AI-supported teaching materials.

This paper is based on a doctoral thesis conducted at the Institute of Social Sciences at Trakya University.

Keywords: ChatGPT, vocabulary teaching, material development, listening comprehension, speaking skills

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Introduction

In recent years, it has frequently been emphasised that approaches to foreign language teaching relying exclusively on textbooks are insufficient and that learners' motivation tends to decline when they are not exposed to media-based contemporary content (Lis, 2019). Particularly at the level of higher education, teaching materials embedded in social and cultural contexts contribute substantially to the sustainable development of language skills (Kužnar, 2022).

Media-based current content enables learners to encounter authentic language input and enhances the overall attractiveness of classroom instruction. However, the integration of such content into teaching often requires an intensive preparation process. In particular, extracting transcripts from news videos and transforming them into pedagogically usable materials places a considerable workload on teaching staff.

In this context, generative artificial intelligence tools offer innovative solutions that save time and increase instructional flexibility. ChatGPT is therefore not only regarded as a technical tool but also as a didactic partner, given its capacity to generate transcripts and create learning activities suitable for different proficiency levels (Münch-Manková, Sailer & Pickal, 2025; Katanneck & Suner, 2024). This paper examines the use of ChatGPT in teaching German as a foreign language (DaF) by means of the short news format "Tagesschau in 100 Sekunden" published by ARD. The focus lies particularly on transcript generation, vocabulary development, and the creation of discussion questions. The study is based on a six-week implementation in a university preparatory programme.

Following this introduction, the paper addresses the role of media-based content and artificial intelligence in foreign language teaching, before presenting the methodology, findings, and conclusions.

The Role of Media-Based Current Content

The use of media-based current content in foreign language teaching enhances both learner motivation and linguistic awareness by providing authentic language input. Short and up-to-date formats such as news videos enable learners to engage not only with grammatical structures but also with relevant social contexts. Consequently, resources such as "Tagesschau in 100 Sekunden" represent a valuable supplement to teaching materials used in university preparatory programmes. Kužnar (2022) emphasises that media-based current content plays a particularly important role in language learning by providing meaningful context and fostering motivation, while Lis (2019) highlights its positive effect on learners' engagement.

The Use of Artificial Intelligence and ChatGPT in Foreign Language Teaching

In recent years, artificial intelligence-based applications have gained increasing importance as innovative approaches in foreign language teaching. Generative AI tools are particularly noteworthy for accelerating material preparation processes, supporting individualised learning paths, and opening up new didactic possibilities for teachers. Münch-Manková, Sailer, and Pickal (2025) analyse the integration of artificial intelligence into DaF/DaZ instruction in detail and demonstrate that such tools entail both opportunities and challenges.

ChatGPT is not only a tool that reduces teachers' workload but can also be regarded as a didactic partner within the learning process. Katanneck and Suner (2024) show that ChatGPT can be used effectively, particularly in writing processes, where it serves as a valuable source of feedback and supports the development of learners' self-regulated learning strategies.

Material Selection, ChatGPT's Contribution, and Participants

This section first outlines the material selection process and the reasons for choosing the news videos "Tagesschau in 100 Sekunden". It then discusses ChatGPT's contribution to adapting these materials for instructional purposes, particularly in transcript preparation and exercise development. Finally, information about the participant group is presented to contextualise the study.

Materials

The primary materials used in this study consist of short news videos titled "Tagesschau in 100 Sekunden", published by ARD. The programme's focus on current events, its ability to convey substantial information within a short time frame, and its regular publication make it particularly suitable for foreign language teaching. Obermoser (2018) likewise emphasises that modern media tools, especially video-based content, can enhance both learner motivation and the quality of linguistic input when applied in a pedagogically sound manner.

Use of ChatGPT

ChatGPT was employed to generate transcripts of the news videos, develop gap-fill exercises, compile vocabulary lists, and create discussion questions. During the transcription phase in particular, converting audio directly into text resulted in substantial time savings compared to earlier manual procedures. Voice-typing functions in tools such as Microsoft Word were tested; however, these tools frequently encountered difficulties in accurately transcribing foreign proper names and geographical references. In contrast, ChatGPT produced considerably cleaner and more accurate transcripts, thereby significantly reducing preparation time.

The implementation lasted six weeks. A pre-test conducted in the first week assessed students' initial proficiency levels. Throughout the six-week period, "Tagesschau in 100 Sekunden" videos and Quizlet-based activities were used at least twice per week, typically during the first lesson of the day. After viewing the video, students worked with the transcript, vocabulary list, and discussion questions generated by ChatGPT. At the end of the sixth week, a post-test using the same assessment instrument was administered, allowing for a systematic comparison of pre- and post-test results.

Participants

The study was conducted with 73 preparatory-class students enrolled in the School of Foreign Languages at a state university. The six-week intervention was integrated into the regular course schedule. At this stage of the programme, participants had reached the B2 proficiency level, which requires the ability to engage with academic texts and discussions beyond basic communicative competence. The primary objective of the study was to prepare students for examinations such as TestDaF, which demand a high level of vocabulary knowledge and text comprehension.

Findings

The findings obtained in this section are presented under four headings. First, the process of preparing transcripts and ChatGPT's contributions to this process will be discussed. Next, material production and the contribution of these materials to students' vocabulary will be examined, and finally, feedback from students will be evaluated.

Transcript Creation Process

As the first step of the study, transcripts of news videos were automatically generated using ChatGPT. Previously, instructors had to repeatedly pause the video and transcribe it manually to obtain these transcripts, which was quite time-consuming. Thanks to the speed provided by ChatGPT, this preparation time has been significantly reduced. In particular, its ability to recognize the audio of the video and convert it to text has been found to be more reliable compared to tools such as Google Docs. This is because Google Docs often struggles to correctly identify proper nouns such as foreign names, city and country names, whereas ChatGPT offers a cleaner and faster solution in this regard.

Material Production

Following the rapid acquisition of transcripts, various materials appropriate to the course objectives were developed. These materials include fill-in-the-blank exercises tailored to the language level, target word lists, comprehension questions, and discussion questions. Previously, preparing such materials was quite time-consuming for teaching staff. With ChatGPT's help, the preparation time has been reduced, and teachers have been able to integrate the content into their lessons much more quickly. Similarly, recent studies indicate that artificial intelligence tools can reduce the burden on teaching staff by facilitating pre-class preparation processes (Fremdsprachenunterricht mit KI gestalten, 2023).

Vocabulary

Thanks to the use of the prepared materials, students have encountered a richer vocabulary. This has not been limited to the word lists found in textbooks, but has also included expressions used in contemporary German. Students have been able to go beyond the boundaries of the classroom by becoming familiar with current words and phrases that frequently appear in news videos. This has provided a significant advantage, particularly in the preparation process for advanced-level exams such as TestDaF. For example, Bauer (2023) has shown that although the vocabulary presented in textbooks is generally extensive, the frequency of repetition is low, and this can limit the permanence of learning. In this context, materials supported by current media content have played an important complementary role in students' vocabulary acquisition. This finding is also consistent with Lis's (2019) view that current media content in foreign language teaching increases students' interest and contributes positively to the learning process.

Student Feedback

Feedback received from students during the implementation period shows that media-based materials significantly increased interest in the course. Students stated that the 100-second news videos were appealing due to their linguistic and social content, which increased their motivation in class. Furthermore, the variety of transcripts and exercises generated with the help of ChatGPT helped students learn words in context.

The responses to the survey and open-ended questions conducted at the end of the application showed that the vast majority of students (82%) found the “100-Second News” videos useful. Students stated that the short and dense content of the news improved both their vocabulary and listening skills. One student commented, “Using the new words we learned in sentences is very effective in helping us remember them.” Quantitative findings also support these views: Students' scores on “knowledge of using news videos in language learning” increased significantly from the pre-test ($M = 1.86$) to the post-test ($M = 2.02$), corresponding to an increase of approximately 9% ($t(72) = –4.150$, $p < .001$). The findings reveal that news videos increased students' linguistic awareness as well as their cultural interest and motivation.

Results and Discussion

This section discusses the contributions of ChatGPT to foreign language teaching based on the research findings. Its impact on preparation time, contributions to students' vocabulary, motivational effects, and results on discussion practice are addressed under separate headings. The benefits provided from the perspective of teaching staff are also specifically addressed.

Impact on Preparation Time

The findings show a significant reduction in teaching staff preparation time. Thanks to ChatGPT, transcripts and materials can be prepared much more quickly, facilitating pre-class preparation and allowing teachers to direct their energy towards more pedagogically creative activities.

Contribution to Vocabulary

The materials used in the study enabled students to learn words and phrases used in contemporary German, not limited to the textbook content. This provides a significant advantage, especially in the preparation process for exams such as TestDaF, which require a high level of vocabulary knowledge and academic expression skills.

Student Motivation

The use of current media content has enabled students to interact not only with linguistic structures but also with social and cultural contexts. Findings show that students find it motivating when topics covered in class are connected to daily life and media. In particular, the Tagesschau in 100 Sekunden videos, which provide a large amount of information in a short time, helped them focus without distraction.

These results are consistent with Kužnar's (2022) findings that media-based current content supports the learning process by increasing student motivation in foreign language teaching.

Discussion Practice

Discussion questions created quickly with the help of ChatGPT increased classroom interaction and encouraged students to express their ideas not only in linguistic but also in cultural contexts. The wide range of topics, from political developments to environmental issues, supported critical thinking as well as discussion skills.

Contributions for Teaching Staff

Research shows that ChatGPT offers significant contributions not only for students but also for teaching staff. The time saved during preparation has given teachers the opportunity to plan more flexibly and diversify their lessons pedagogically. Furthermore, using this technology has also improved teaching staff's ability to work with digital tools. In this regard, teachers integrating media-based content into their lessons also serves to keep the cultural context constantly visible in the teaching process, as emphasized by Kužnar (2022).

Conclusion and Limitations

Although the findings of this study are promising, several limitations must be acknowledged. Artificial intelligence tools do not always produce error-free results; therefore, instructor supervision remains essential, particularly with regard to proper names and cultural references. In addition, the six-week duration of the study does not permit conclusions about long-term effects. Future research should therefore include longer-term implementations across different proficiency levels.

In conclusion, the use of AI-supported tools in foreign language teaching is expected to become increasingly widespread. Such applications have the potential to support teachers' pedagogical creativity and to make language learning more interactive and personalised.

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The Potential of AI-Supported Feedback in German as a Foreign Language Writing Instruction: The Use of ChatGPT to Promote Text Type-Oriented Writing Skills

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Abstract

The aim of this paper is to describe the extent to which AI-assisted feedback can support the process of teaching writing in German as a foreign language. The study is based on an empirical doctoral research project that was developed and implemented in a university preparatory programme in Türkiye and conducted within a genre-focused writing instruction framework. Drawing on Hayes's (2012) writing process model and the three-ring model proposed by Bachmann and Becker-Mrotzek (2017), the project systematically taught the target group the fundamental stages of the writing process. While Hayes (2012) conceptualises writing as a cognitive and recursive process consisting of planning, formulation, and revision, Bachmann and Becker-Mrotzek (2017) emphasise the interplay between genre knowledge, writing strategies, and communicative requirements. Within this framework, genre awareness emerges as a key factor influencing the quality of students' argumentative texts.

Against this background, AI applications are positioned not as a substitute for instruction in writing, but as a complementary didactic tool that can support the teaching process. As an extension to the doctoral study, this paper illustrates, through a representative example, how ChatGPT, an AI-based language model, can be used to generate feedback. Using sample prompts, the paper examines ChatGPT's responses to student texts, focusing on how it evaluates argumentative structures and linguistic coherence and on the extent to which it provides useful suggestions for revision. The representative evaluation indicates that AI offers notable advantages in terms of immediate feedback, guidance towards genre patterns, and grammatical correction; however, it also has limitations with regard to depth of focus and contextual interpretation.

Keywords: artificial intelligence, writing skill development, teaching German as a foreign language, feedback, genre competence

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Introduction

In recent years, it has become increasingly evident that traditional approaches to foreign language teaching that place the coursebook at the centre are no longer sufficient. Learners are expected to move beyond merely acquiring the structural features of the language and to use it functionally in real communicative contexts. Accordingly, they need to be able to produce meaningful texts across different situations, express their ideas in a systematic way, and shape their texts in line with the conventions of the relevant genre. For these reasons, writing instruction is widely regarded as one of the most complex and cognitively demanding processes in foreign language education.

The theoretical foundation of this study rests on two models that conceptualise writing as a cognitive process while simultaneously emphasising the text-oriented nature of writing. Hayes (2012) defines the writing process as a recursive cognitive cycle consisting of planning, formulation, and revision. Within this model, writers are required to manage a range of sub-processes throughout the act of writing, including planning, retrieving information, organising, and evaluating. In this sense, writing is not only a matter of learning to write; it also functions as a way of learning through writing. Bachmann and Becker-Mrotzek (2017), by contrast, describe writing as a dynamic interplay between genre knowledge, strategic planning, and communicative purposes, and they underline that writing is a teachable skill. Taken together, the two models suggest that the cognitive dimension of writing operates in reciprocal interaction with textual structure. From this perspective, writing is not only a mental activity, but also a process grounded in the construction of textual integrity.

At this point, a text-linguistic perspective becomes central to writing pedagogy. Ensuring cohesion and coherence in the texts produced during writing instruction, while at the same time developing learners' genre competence, plays a decisive role. Brinker (2010) emphasises that a text must exhibit unity not only at a structural level but also at the level of meaning, and he points to the importance of genre knowledge in establishing such unity. Adamzik (2016) similarly argues that genre should be analysed in terms of its formal, communicative, and functional dimensions. Genre thus offers a framework that brings together both the cognitive and the functional components of the writing process.

These approaches make it necessary to adopt a holistic perspective on writing classes in contemporary foreign language education. In this context, instructional goals should not be limited to the internal context of the text, but should also include the external context in which the text is produced. Moreover, enabling learners to produce texts that are grammatically accurate, functionally coherent, and appropriate to their communicative purpose should be regarded as one of the key sub-goals of this approach.

In recent years, the growing use of digital tools and AI-assisted applications in language teaching has opened up new didactic possibilities for the writing process. Language models such as ChatGPT can support learners in idea generation, text planning, revising, and improving linguistic accuracy. Tekin (2023) notes that ChatGPT can be considered a tool that enriches individual feedback processes in teaching German as a foreign language and enhances learners' motivation to write.

At the same time, it should be kept in mind that AI tools cannot replace teacher guidance; rather, they can only complement it. In this sense, AI applications should be viewed not as an end in themselves, but as instruments within instruction. The teacher's task is to integrate these technologies into classroom practice in a deliberate and informed way, to draw on their potential in line with pedagogical objectives, and to guide the overall process. The learner's role, in turn, is to use AI applications actively and responsibly in order to pursue their own learning goals. Against this background, the aim of this paper is to identify the function AI-assisted feedback can assume in teaching German writing and to evaluate whether ChatGPT contributes to students' text production processes.

Method

Participants and Implementation Process

At the level of the texts produced by the students, the type, depth, and instructional value of the feedback generated by ChatGPT were described, and the feedback was evaluated in terms of its potential contribution to learner-centred writing pedagogy. The implementation was carried out with eight B2-

level students enrolled in a university preparatory programme. After receiving a short genre-focused writing training, the participants wrote short argumentative texts on specific topics. These texts were then submitted to ChatGPT, and feedback was requested with regard to grammatical accuracy, coherence, cohesion, and argumentation. The primary focus of the study is not the student texts themselves, but the quality and instructional value of ChatGPT's feedback on these texts. The feedback was analysed along three dimensions:

- grammatical and lexical feedback,
- feedback on text structure and coherence,
- feedback on content and the quality of argumentation.

Data Collection and Evaluation

Each piece of feedback produced by ChatGPT was evaluated according to the criteria of instructional value, depth, contextual appropriateness, and learner-centredness. The prompts addressed to ChatGPT were grouped into three categories based on their function across different stages of the writing process: scaffolding, evaluative, and corrective prompts. This categorisation made it possible to examine the scope of the model's feedback in a systematic manner.

In this process, Brinker's (2010) text-linguistic criteria of coherence and cohesion, the writing model proposed by Bachmann and Becker-Mrotzek (2017), and Hayes's (2012) cognitive framework served as key points of reference. In addition, short reflective notes were collected from the students regarding the feedback generated by ChatGPT. These data provided additional qualitative insights into learners' perceptions of AI-assisted feedback and its perceived usability.

Limitations

The study was conducted with a small sample and focused on only one language model (ChatGPT). For this reason, the findings cannot be generalised; however, the study provides preliminary evidence regarding the nature of AI-assisted feedback.

Using ChatGPT in the Writing Process

Bu çalışmada In this study, writing is conceptualised as a multi-layered activity in which cognitive planning and textual production interact (Hayes, 2012; Bachmann & Becker-Mrotzek, 2017). Within this process, feedback is one of the key components that supports learners' progress in terms of both linguistic accuracy and textual integrity.

AI-based tools open up new possibilities within this process and are viewed as complementary to teacher guidance. In particular, ChatGPT has become a pedagogically usable tool in writing instruction by combining cognitive support with text-oriented guidance.

With reference to Ellis's (2009) typology of written corrective feedback, the suggestions offered by ChatGPT can be characterised as "electronic" and predominantly "indirect feedback." Rather than directly correcting errors, this type of feedback encourages learners to reflect on their own production. Uzun and Köksal (2020) likewise emphasise that indirect feedback promotes analytical thinking and enables learners to participate actively in the revision process.

Steinhoff (2025) argues that ChatGPT can assume three roles in the writing process: Ghostwriter, Writing Partner, and Writing Tutor. Adopting a learner-centred approach, the present study focuses on the roles of Writing Partner and Writing Tutor. The students wrote prompts in their native language (Turkish) in order to receive feedback on their German texts. The model produced corrections in German, while providing explanations in Turkish. This bilingual interaction supported the development of both learners' language awareness and their metacognitive monitoring skills.

The ChatGPT-based implementation covers three stages of the writing process: pre-writing, drafting, and revising. At each stage, students submitted different prompts to ChatGPT to guide their writing process. During the pre-writing stage, students generated ideas on a specific topic and asked ChatGPT for argument suggestions.

Sample prompt: "Şehir merkezlerinde araba kullanımını azaltmak konusuyla ilgili Almanca argüman fikirleri verebilir misin?"

During the drafting stage, the model evaluated student texts in terms of linguistic accuracy and coherence, and it strengthened transitions by suggesting connectors such as "darüber hinaus" and "im Gegensatz dazu."

Sample prompt: "Aşağıya yazdığım paragraf tutarlı mı? Almanca olarak uygun mu?"

During the revision stage, students asked ChatGPT to correct their texts in German.

Sample prompt: "Metnimi Almanca olarak düzeltir misin ama anlamı değiştirme lütfen?".

Subsequently, students critically evaluated the model's suggestions and decided which changes to accept and which to reject in their own texts. In this process, ChatGPT functioned not merely as a corrector but as a writing supporter that encouraged reflective thinking. These three prompt types (scaffolding, evaluative, and corrective) helped systematise students' interactions with ChatGPT. The model's suggestions were discussed in context and adapted to the students' proficiency level, the genre, and the learning objectives. Overall, this implementation indicates that ChatGPT can be used as a tool that complements teacher guidance without replacing it. Sample excerpts from student prompts and ChatGPT's feedback are presented in detail in the Findings section.

Findings

The implementation results indicate that ChatGPT effectively supported students' writing processes from cognitive, linguistic, and text-linguistic perspectives. By drawing on the feedback provided by the model, students made structural, linguistic, and content-related improvements in their texts. This process operationalised, in a concrete way, the planning, production, and revision cycle described in Hayes's (2012) writing process model. ChatGPT's feedback was analysed at three levels.

Example of grammatical feedback

Stundent prompt: "Metnimi kontrol eder misin, fiilin yerini doğru kullanmış mıyım?"

Student text: In Deutschland, kann man überall mit dem Fahrrad fahren weil, sie Fahrradwege haben dort.

ChatGPT- generated feedback: Virgül kullanımı: "In Deutschland"dan sonra virgül gelmez. Bağlaç "weil": Virgül "weil"den önce gelir; "weil"den sonra virgül gelmez. Yan cümle sözdizimi: "weil" yan cümlede fiili sona atar. Zamir/özne uyumu: "sie" belirsiz. Genel bir ifade için "es gibt" yapısı uygundur. Doğru biçim: In Deutschland kann man überall mit dem Fahrrad fahren, weil es dort Fahrradwege gibt.

Student revision: In Deutschland kann man überall mit dem Fahrrad fahren, weil es dort Fahrradwege gibt.

Example of feedback on text structure and coherence

Student prompt: "Cümlelerim arasında bağlantı eksik mi, nasıl daha akıcı yapabilirim?"

Student text: Bei uns in der Türkei viele Leute benutzen Autos, aber das ist schlecht. Ein Beispiel dafür ist Istanbul. Die Luft ist schlecht hier.

ChatGPT- generated feedback: Cümleler arasında bağdaşıklık eksikliği vardır; fikirler arasında ani geçişler bulunmaktadır. "aber" bağlacı yerinde, ancak cümleler arasına neden-sonuç ve örnek ilişkisini güçlendiren ifadeler eklenebilir. Önerilen bağlaçlar: deshalb, darum, nämlich, besonders in großen Städten wie Istanbul.

Student revision: Bei uns in der Türkei benutzen viele Leute Autos, und das ist schlecht für die Umwelt. Deshalb ist die Luft, besonders in großen Städten wie Istanbul, sehr schlecht.

By adding "deshalb" and "besonders in großen Städten wie Istanbul", the student made the text more fluent and improved its overall semantic unity.

Example of feedback on content and argument quality

Student prompt: "Argümanımı güçlendirebilir misin? Çok basit mi olmuş?"

Student text: Autos sind schlecht für die Umwelt.

ChatGPT- generated feedback: "Argümanını güçlendirmek için bir örnek ekleyebilirsin, örneğin: ...weil sie CO_2 ausstoßen und zur Luftverschmutzung beitragen."

Student revision: "Autos sind schlecht für die Umwelt, weil sie CO_2 ausstoßen."

These examples show that the model provided concrete, learning-oriented support with regard to both linguistic accuracy and textual integrity. The overall trend of the findings is summarised in the table below, which outlines the nature of ChatGPT's contribution across the three main feedback types (grammatical, textual, and content-related).

Table 1.

Types of ChatGPT Feedback, Their Functions, and Student Responses

Feedback Type	Function and Focus	ChatGPT's Contribution	Student Response / Reflective Evaluation
Grammatical and Lexical Feedback	Drawing attention to errors in verb placement, articles, inflection, and word choice.	Provided grammatically correct versions of erroneous sentences, thereby fostering grammatical awareness.	"I noticed my mistakes more easily. The explanation helped me understand why my sentence was incorrect."
Feedback on Text Structure and Coherence	Strengthening transitions between sentences and improving logical links.	Suggested appropriate connectors and made textual transitions more natural.	"I realised how important connectors are. Now I can build sentences more fluently."
Content and Argumentation Feedback	Supporting arguments with reasons and examples.	Suggested reasons and examples that increase argumentative depth.	"The suggestions were very helpful, but sometimes I found the examples disconnected from the context."

As shown in Table 1, ChatGPT's feedback created learning opportunities in terms of both linguistic accuracy and textual cohesion. The students' reflective notes suggest that they found the model's suggestions motivating and time-saving, while also noticing limitations in terms of contextual depth.

Taken together, these findings offer important indications of the pedagogical value of AI-assisted feedback in writing instruction. In the following section, the results are discussed in relation to the theoretical framework.

Discussion and Conclusion

The findings indicate that ChatGPT supported students' development particularly in the areas of linguistic accuracy, textual integrity, and argumentative structure. These results align with Hayes's (2012) writing process model by suggesting that the planning–production–revision cycle can be activated in a tangible way with the support of AI. In this context, the model proposed by Bachmann and Becker-Mrotzek (2017), which conceptualises writing as an interaction between strategic planning and communicative purposes, provides a meaningful framework for understanding the process. Through the immediate feedback offered by ChatGPT, students developed greater genre awareness and approached the writing process more consciously.

As Hartmann (2021) argues, the pedagogical value of AI tools becomes evident when their use is framed and guided by teacher support. If used superficially, learning may remain at a surface level. For this reason, ChatGPT should be treated only as a complementary component and its use should be guided under teacher supervision.

In conclusion, the effective use of ChatGPT for developing writing skills in German depends on the quality of instructional design and the strength of teacher–student interaction. When used with appropriate guidance, the model can enhance genre awareness, make the writing process more

transparent, and contribute to sustained improvements in learners' language production. At the same time, AI should not be placed at the centre of instruction, but should be integrated deliberately as a supportive element. Future research could examine the long-term impact of AI-generated feedback on writing development across different samples and learning contexts.

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AI in the Classroom: Rethinking Essay Writing and Foreign Language Didactics with Pre-Service Teachers

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Abstract

The rapid advancement of artificial intelligence (AI) is transforming foreign language education, particularly in translation and essay writing. This study investigates tertiary-level students' perceptions, attitudes, and experiences regarding integrating AI tools in their English and German language learning process, focusing particularly on writing tasks. Special attention is given to how students engage with AI-powered tools such as machine translation services (e.g., Google Translate, DeepL) and generative AI models (e.g., ChatGPT, Grammarly) and the perceived benefits and concerns these tools bring. The aim is to inform future pedagogical practices and curricular decisions by understanding the implications of AI use for language acquisition, creativity, and critical thinking. A survey-based approach was employed to collect data from tertiary-level pre-service teachers studying at the class-teacher and preschool teacher departments. The instrument captured students' usage patterns of AI tools for essay writing, their levels of trust and concern, and their general attitudes toward the role of AI in education. Descriptive statistics and confidence intervals were used to analyze the extent of AI use, while correlation analysis assessed the relationship between students' preferences for AI and actual usage behavior. While students recognize the practical benefits of AI, such as instant feedback and enhanced language proficiency, they are also aware of potential risks, including diminished writing autonomy and creativity.

Keywords: AI, Essay Writing, Foreign Language Didactics, Pre-Service Teachers of Education

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Introduction

With the increasing presence of AI-powered tools such as machine translation (e.g., Google Translate, DeepL) and generative AI models (e.g., ChatGPT, Grammarly), students and educators are faced with new opportunities and challenges in English language education. While these tools can enhance learning by providing instant feedback and improving language proficiency, there are concerns about their impact on students' writing autonomy, linguistic creativity, and critical engagement with texts (Karimovna, 2025). The same author also highlights concerns that AI is redefining communication, literacy, and cultural identity in the digital age (ibid.). Nevertheless, she also gives special attention to "the role of AI in language learning and teaching, where adaptive platforms and intelligent tutors promote individualized learning paths" (ibid, p. 241).

This research has a potential because it investigates how future educators perceive and utilize AI in their learning process. Understanding their attitudes and experiences will help educators and policymakers design effective strategies for integrating AI in language education while addressing potential drawbacks. Furthermore, as AI continues to evolve, it is crucial to establish pedagogical frameworks that ensure students develop both AI-assisted and independent writing with a focus on deep learning in natural language processing (Hinton, 2021). By focusing on tertiary-level students, this study provides valuable insights into how AI may shape the future of foreign language teaching and learning, particularly English and German, among pre-service students in academic settings, with broader implications for educational practices worldwide.

Literature Review

There are several key insights into how AI can shape the future of English and German language education, particularly by enabling faster text translation and more efficient essay writing. AI tools can support students outside the classroom by helping them understand complex texts, compare linguistic structures, enhance translation accuracy, and develop essays on various topics. However, challenges arise when students copy and paste AI-generated content without applying critical thinking or evaluating its contextual appropriateness (Cirkovic-Miladinovic, 2024). Future English teachers, currently tertiary-level students, can use AI to illustrate nuances of meaning, cultural distinctions, and contextual appropriateness in writing. However, AI-generated translations are not always accurate, which requires students to apply critical evaluation skills in order to refine and adapt the output from their mother tongue (in this case, Serbian) into natural-sounding English before producing their final written work (Silver & Hassabis, 2019).

In terms of improving writing proficiency and feedback quality, AI-based writing assistants (e.g., Grammarly, ChatGPT) provide instant grammar corrections, vocabulary suggestions, and stylistic enhancements, helping students refine their essays. These tools can assist in developing structured arguments, expanding ideas, and avoiding common mistakes. Floridi and Chiriatti (2020) cite (Elkins and Chun 2020) who state that GPT-3 writes better than many people and that its availability represents the arrival of a new age. Elkis and Chun (2020) go on with naming in which areas GPT-3 can assist: translations, summaries, minutes, comments, webpages, catalogues, newspaper articles, guides, manuals, forms to fill, reports, recipes etc. It is likely that AI tools will soon be capable of composing, or at least producing initial versions of, texts that currently depend on human writers. This development represents the most profound change in writing practices since the introduction of the word processor. Some of its major implications can already be anticipated so the foreign language education is already facing many challenges.

An important challenge is preventing students from becoming overly reliant on AI, as such dependence may weaken their capacity for independent and creative writing (Cirkovic-Miladinović, Dabić & Suzić, 2013). AI can analyze students' strengths and weaknesses and suggest personalized exercises for improving writing skills with a present of a teacher who will lead the learning process and point out to the specific real-time recommendations and tailor content to students' proficiency levels. In the local academic context, AI can support students with different learning paces, making language learning more inclusive (ibid.).

According to Shukla and Pandey (2025), AI as a collaborative learning tool can enhance classroom practices. Students can engage in peer-reviewed, AI-assisted writing activities in which the AI offers suggestions while human collaboration fosters critical thinking and creativity. Such practice can be implemented through workshops where students analyse AI-generated texts, identify errors, and discuss possible improvements (Abbood et al., 2025). Given that students at the Faculty of Education are being trained as future teachers, it is essential that they understand the role of AI in language education. They should learn how to integrate AI effectively into their teaching methods while maintaining a human-centred pedagogical approach. Although AI can support the development of lesson plans, the creation of teaching materials, and the assessment of student progress, teachers remain indispensable in guiding, motivating, and inspiring learners.

The primary concern we currently face relates to academic integrity, plagiarism, and originality in student writing. Educators should help students distinguish between AI-assisted output and their own creative contribution, thereby promoting responsible and transparent use of AI tools (Nguyen, 2023). To achieve this, learners need to develop critical literacy skills that enable them to evaluate AI-generated content for bias, inaccuracy, and ethical implications.

For these reasons, our research explores students' attitudes toward and experiences with AI in order to provide insights that may contribute to the development of institutional policies supporting the responsible integration of AI in education. The findings from this local study might also offer considerations for best practices in other institutions, given that the adoption of AI in education appears to be an emerging global trend. Furthermore, AI has been suggested to have the potential to lessen disparities in language learning by increasing access to educational support, irrespective of students' geographic or socioeconomic background.

Method

A quantitative method and a survey-based approach was employed to collect data from tertiary-level pre-service teachers studying at the class-teacher and preschool teacher departments. The instrument captured students' usage patterns of AI tools for essay writing, their levels of trust and concern, and their general attitudes toward the role of AI in education. Descriptive statistics and confidence intervals were used to analyze the extent of AI use, while correlation analysis assessed the relationship between students' preferences for AI and actual usage behavior. A total of 120 undergraduate students participated in the study, completing surveys on their use of AI tools such as Google Translate, DeepL, Grammarly, and ChatGPT.
The study aims to answer the following research questions:

1. To what extent do tertiary-level pre-service teachers use AI tools for essay writing?
2. How do pre-service teachers perceive the reliability and accuracy of AI-generated translations in academic contexts?
3. What concerns do pre-service teachers express regarding the impact of AI use on students' creativity and independent writing skills?
4. What preferences do pre-service teachers have toward AI-assisted learning, and how do these preferences influence their attitudes toward language education?

The questionnaire, in the form of a five-level Likert scale, consisted of three sections, each addressing specific research questions. The first section examined pre-service teachers' use of AI tools for essay writing, including purposes and frequency, corresponding to the question of how and to what extent these tools are used. The second section explored participants' experiences with AI in academic writing, focusing on perceived reliability, accuracy of AI-generated translations, and concerns about its impact on students' creativity and independent writing. This addresses the questions about trust in AI outputs and potential drawbacks for learning. The final section investigated pre-service teachers' attitudes toward AI in education and their preferences for AI-assisted learning, shedding light on how these preferences shape their perspectives on language education.

In summary, the survey instrument effectively captured both the usage patterns and attitudes of tertiary-level pre-service teachers toward AI tools in academic writing. By aligning each questionnaire section

with specific research questions, the study provides a comprehensive framework for analyzing the extent of AI use, perceptions of reliability, concerns about creativity and independence, and preferences for AI-assisted learning among future educators. The data collected from 120 participants offer a robust basis for addressing the study's research questions and for exploring the implications of AI integration in language education.

Findings and Discussion

The first objective was to investigate in pilot study whether students use AI more for writing or for translation purposes. Accordingly, the initial hypothesis was that students use AI for translation more than for writing. As shown in Table 1, the data support this hypothesis, meaning 74% of students use AI for translation while 59% use it for essay writing. However, for the purposes of this study, the focus is on AI use for writing; therefore, the data presented in the following sections will concentrate exclusively on writing activities in foreign language learning at the tertiary level.

Table 1.
Differences in Translation and Writing Performance Using AI

Variable	Mean (M)	Stand. Dev. (SD)	Interpretation
AI Translation Use	0.74 (74%)	0.44	74% of students use AI for translation.
AI Essay Use	0.59 (59%)	0.49	59% use AI for essay writing.

Examining the structure of the participants, 80% reported using AI, with 50% using AI tools regularly (at least once a week) and 30% using them only when necessary, such as before exams or for writing assignments. In contrast, 20% of students indicated that they do not use AI for either writing or other purposes (see Table 2). The preferred tools among this sample were, in order of preference, ChatGPT, Grammarly, Google Translate, and DeepL. Students' self-reported that they believe that AI enhances their foreign language learning experience and see this as a benefit.

Table 2.
The Frequency in Using AI and Preferred Tools

Category	Proposed Number	Interpretation
AI Users	80% of students	Estimated percentage of students who use AI tools for translation or writing.
Frequent AI Users	50% of students	Students who use AI tools regularly (at least once a week).
Occasional AI Users	30% of students	Students who use AI tools only when needed (e.g., before exams, for assignments).
Non-AI Users	20% of students	Those who prefer traditional learning methods.
Preferred AI Tools	60% ChatGPT, 50% Grammarly, 40% Google Translate, 20% DeepL	Multiple responses allowed; ChatGPT and Grammarly are expected to be the most used tools.
Perceived AI Benefit	85% say AI improves learning	Students' self-reported belief that AI enhances their language learning experience.
Concerns About AI	65% fear over-reliance, 40% worry about plagiarism	Key concerns students express regarding AI integration.

The participants were also asked about their concerns regarding AI. Of these, 65% reported fearing over-reliance, while 40% expressed concerns about plagiarism and improper referencing when using other authors' words (Table 2).

Further, the study aimed to investigate perceptions of AI reliability, concerns about creativity, and preferences for AI-assisted learning. As shown in Table 3, 70% of the students reported recognizing AI's strengths but remaining cautious about its accuracy, particularly with idiomatic expressions and

cultural references in writing tasks. Regarding creativity, 52% of students expressed concern that AI may limit originality in writing and thereby reduce creative outcomes. Preferences for AI-assisted education were evenly split, with half of the students favoring AI integration and the other half still valuing traditional teaching approaches.

Table 3.
AI Reliability, Creativity Concerns, and AI-Assisted Learning Preferences

Variable	Mean (M)	Stand. Dev. (SD)	Interpretation
Perceived Reliability of AI	0.70 (70%)	0.46	70% trust AI-generated translations.
Concerns About Creativity	0.52 (52%)	0.50	52% worry AI may reduce creativity.
Preference for AI-Assisted Learning	0.50 (50%)	0.50	Half of the students prefer AI-assisted education.

Confidence intervals were calculated to provide a range in which the true population mean is likely to fall, offering more reliable insights into the study's results. The 95% confidence interval was computed for each key variable, with the results presented in Table 4. The proportion of students using AI for writing is likely between 50.2% and 68.1%. Then, the percentage of students concerned about potential creativity loss is estimated between 42.6% and 60.7%. Finally, the proportion of students who prefer AI-assisted learning over traditional methods ranges from 40.9% to 59.1%.

Table 4.
Confidence Intervals

Variable	95% Confidence Interval (CI)
AI Essay Use	(50.2% – 68.1%)
AI Reliability	(61.7% – 78.3%)
AI Creativity Concern	(42.6% – 60.7%)
AI Preference	(40.9% – 59.1%)

To determine whether a relationship exists between AI use and students' preferences for AI-assisted learning, a correlation analysis was conducted. Specifically, the correlation between AI use for essay writing and students' preference for AI-assisted learning was examined to assess whether higher AI usage is associated with greater preference for AI integration. The Pearson correlation coefficient (r) was calculated to determine the strength and direction of this relationship.

Table 5.
Correlation Analysis

Comparison	Correlation (r)	p-value	Interpretation
AI Essay Use & AI Preference	**-0.119**	0.197	Weak negative correlation; students using AI for essay writing do not significantly prefer AI-assisted learning.

Specifically, since the p-value was greater than 0.05, this correlation is not statistically significant (see Table 4). This indicates that AI usage does not strongly influence students' preference for AI-assisted learning, suggesting that students may use AI regardless of their learning preferences.

Conclusion and Pedagogical Implications

The results of this study reveal several key findings. Descriptive statistics show that 59% of students use AI tools for essay writing, with confidence intervals indicating that usage likely falls between 50.2% and 68.1%. A majority of students (70%) express trust in AI tools, a figure significantly higher than the 52% who are concerned about a potential loss of creativity, suggesting a general acceptance of AI despite pedagogical reservations. Interestingly, the correlation between students' preference for AI and their

actual use is weak ($r = -0.119$ for essay writing), indicating that the use of AI tools largely occurs independently of personal learning preferences.

Taken together, these findings suggest that while AI is widely used among students, it is not universally preferred, highlighting the need for educators to integrate AI selectively rather than assume all students favor AI-assisted learning. Usage patterns further reveal that AI tools are more commonly applied for translation than for essay writing, possibly reflecting concerns about originality and plagiarism. Therefore, rather than allowing students to use AI tools independently, educators should design AI-assisted lessons that promote responsible and effective use.Tools like Grammarly and ChatGPT can enhance writing mechanics, but they should not replace students' critical thinking and creativity. Assignments that combine AI-generated and manually written content allow students to compare outputs and reflect on AI's impact on their writing, while AI-detection tools can help ensure originality. Adaptive AI tutors can further support learning by providing real-time feedback on grammar, vocabulary, and style, tailoring instruction to individual needs. Notably, students' trust in AI is higher than their concern for creativity loss, suggesting that AI can be integrated into curriculum design if appropriate guidelines are in place to preserve originality. To ensure AI enhances rather than hinders language learning, future foreign language education should emphasize AI literacy and ethics, blended learning approaches combining AI with traditional teaching, critical thinking development for evaluating AI-generated content, and encouragement of creativity and originality despite AI assistance. As AI continues to evolve, understanding students' experiences remains vital for its responsible and effective integration into English and German language instruction, with broader implications for educational practices globally.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

Data Availability Statement: The data is not publicly available but authors will provide data to researchers who request access to the study's data.

Conflict of Interest: There is no conflict of interest.

Generative Artificial Intelligence Statement: Generative artificial intelligence (AI) tool - ChatGPT was used for data analysis assistance and language editing. We take full responsibility for the accuracy and integrity of the content.

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Using Persona Dolls in Early Childhood Education to Promote Pedagogical Values

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Abstract

The Persona Doll Approach is an effective way to engage children in discussing important subjects or storytelling since the dolls realistically represent children, their dilemmas, and their feelings. Teachers in kindergarten choose scenarios for the doll's story and engage children by reaching their minds and souls through empathy, kindness, and tolerance. Through doll stories, children can express their worldviews, beliefs, perspectives, and biases, and the doll can help them reconsider these pedagogical values together. The paper will draw insights from kindergarten practice by utilizing the Persona Dolls Approach to promote pedagogical values among preschool children.

Keywords: persona dolls, early childhood education, pedagogy, speech development, storytelling.

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Introduction

Introducing young children to concepts of respect for differences is a crucial part of early childhood education, as it lays the essential groundwork for children's interactions and worldviews to be further fostered in the future. Children develop empathy for those who are different by the color of their skin, physical appearance, background, or abilities in an age before bias can fully form, which reduces the likelihood of bullying and prejudice as they grow older.

The Persona Doll Approach is „an intriguing and child-friendly approach" (Al Jubeh, Vitsou, 2021: 211) used usually among kindergarten and elementary school children for promoting diversity. A Persona Doll is a special type of handmade soft-bodied or rag doll used by educators, often in working with preschool-aged children. The doll is usually 75 cm tall; several dolls are needed, which differ from each other in gender, hair color, eye color, hairstyle, and skin color. In a multicultural environment set can have from 4 to 12 dolls, which represent all races, nationalities, and religions within the group. An educator can make a large rag doll by himself or herself, including children, or with the help of local artists. Dolls are commonly dressed in clothes inherited from preschool children.

Although the Persona Doll Approach has been widespread across continents for decades, persona dolls are not widely used in Serbia. This paper represents the first attempts at using the Persona Doll Approach in early childhood education in Serbia and emphasizes the pedagogical values of this approach.

Literature Review

The Persona Doll Approach was initiated by Kay Taus and Louise Derman-Sparks in the United States during the late 80's (Anti-Bias Curriculum, 1989), and further developed by Babette Brown in the United Kingdom, and by Glenda Mac Naughton in Australia (Derman-Sparks & Olson-Edwards, 2010; Mac Naughton, 2005).

The racial attitudes of children were examined by encouraging symbolic play by using persona dolls (Brown, 2001). The semi-structured interview using persona dolls in pairs was conducted with kindergarten children 4 to 6 years old in a play corner with cushions and toys; the dolls were seated on chairs around the toys (Jesuvadian & Wright, 2011: 279). The symbolic game in pairs is more spontaneous, and children were allowed to explore the setting and touch toys for 15–20 minutes before asking the interview questions. Children were asked to choose one out of four persona dolls that looked like them and were encouraged to play with their dolls and all other dolls. The study „highlights the central role that empathy plays in enabling children to voice their feelings and attitudes about the life stories of others" (Jesuvadian & Wright, 2011: 284).

In a study conducted in a multicultural and conflict-ridden society (secular/religious Jews, Ethiopian-descendant Jews, and Arabs in Israel), kindergarten children were included in positive encounters between four dolls, which represented different nationalities and religions. The findings of this study highlight the potential of reducing intergroup bias in young children in multicultural societies if there are tensions between diverse groups (Nasie, Ziv & Diesendruck, 2022: 1289). The recent study with Turkish and Syrian refugee children attending the same preschool class shows that the Persona Doll Approach has a positive and permanent impact in promoting social values such as „love/tolerance, respect, responsibility, cooperation/helpfulness, and kindness" (Duran Yılmaz & Ömeroğlu, 2024: 763).

Embracing diversity through the Persona Doll Approach among Arabic-speaking refugee or migrant children, from 5 to 10 years old, in a non-formal education context in Greece, in order to „support them in terms of their emotional expression, empowerment and bilingualism or emergent bilingualism" (Al Jubeh & Vitsou, 2021: 211). The Persona Doll Approach was used to nurture the cultural identity of refugee and migrant children by encouraging them to express their bilingual identity through combining languages, and the study shows that children increased their vocabulary both in Greek and Arabic thanks to a warm atmosphere and their identification with the doll (Al Jubeh & Vitsou, 2021: 223). Insider/outsider researcher status dilemma was also a subject of research, and the advantages and disadvantages of both research situations were pointed out (Wilkinson & Wilkinson, 2022).

The Persona Doll Project with undergraduate preservice teachers was conducted „to increase awareness about diversity and apply this awareness to curriculum planning and advocacy for children" (Logue &

Kim, 2011: 60). The South African Persona Doll training project with social work and occupational therapy students provided a practical way to address issues of prejudice (Bozalek & Smith, 2014).

Using persona dolls in the work on child speech development in early childhood education

It is well known that talking to puppets and learning with puppets can be a very stimulative way of introducing children to human rights, encouraging the development of children's positive image of themselves, and nurturing the verbal creativity of young children (Ivon, 2013). With persona dolls, children make strong connections; they can identify themselves with the doll and accept it as a member of the group, so they have an even bigger impact on child speech development than regular puppets.

The educator introduces persona dolls as a new friend who is shy and who asks for advice from children on how to solve a problem. A child-sized doll needs help from children to get to know a new space or to learn the rules of behavior in kindergarten. When introducing children to a new doll, the educator should introduce them to the doll, tell them her name, how old she is, who her family members are, where she lives, or what country she comes from, what she likes, and what her problems are. For example, the doll Tasha is 6 years old, has brown eyes and light brown curly hair, tied in two ponytails. She has a mother, a father, and a sister, whom she is very jealous of. She likes dressing up, spending time in nature, riding a bike, and reading books.

The persona doll person becomes a member of the children's social community and differs from ordinary puppets because it is not a toy. It is used exclusively for telling important stories, which the educator writes down, so that other educators working with the group can also have insight into the course of the story.

A doll does not have a voice of its own, but whispers in a teacher's ear what is bothering her, and an educator asks children to help a new friend solve her problem. An educator may first use a doll to work on what is a difficulty for a whole group of children, such as sharing toys, or a problem that only a group of children has (e.g., adaptation of children who have recently been enrolled). Once the children have become accustomed to talking to the doll, the educator can choose a topic that is significant to only one child, such as a serious illness or the loss of a family member. Dolls of a person in multiethnic environments should be made in such a way that each doll represents a child of a particular nationality, religion, or race. Persona dolls also help children get rid of prejudice against children who are different in any way. When creating the identity of the doll, the educator should try to highlight the differences that exist among children in a particular educational group through the story of the doll. For example, Daniel is a boy of Roma nationality, a cheerful, black-haired, black-eyed, dark-skinned boy, shorter in stature. His best friend is Ljubica, a larger, blonde, and blue-eyed girl with fair skin and rosy cheeks. Ljubica whispers in the teacher's ear that she doesn't like it when children tease Daniel because of his darker skin color, because he is a good boy and her best friend. Daniel whispers that it's ugly that children pick on Ljubica because she loves sweets so much. The teacher invites the children to help Ljubica and Daniel cope with the teasing of their peers and asks them if they have ever been teased by the children. The idea is to encourage children to find solutions.

Dealing with painful topics such as refugees, war trauma, and separation from parents should be made easier for children by creating a narrative centered on a puppet with which they can identify to. A rag doll sits on the teacher's lap, and the teacher introduces it as a new friend. Aleksei came from Ukraine with his mother and grandmother. He misses his dad. He fled the war and came to Syria. He is slowly learning Serbian. He misses his home and his dad. He dreams of returning home. The teacher invites the children to explain to Aleksei why it is better for him to stay in Serbia with his mother and grandmother for at least a while. He encourages the children to think about what they can do for Aleksei to make him feel welcome in his new environment.

And only a child can have a conversation with the doll, by conveying to the children what the doll whispered in his ear. By talking about his feelings through the voice of the doll, the child strengthens his self-confidence, becomes resilient, gets rid of fears, anxiety, feelings of loneliness, and more easily goes through a painful period, because at the same time, he receives the support of peers from his group. In fact, the doll also becomes a member of the children's social group and differs from ordinary dolls, because it is not a toy, but is used exclusively to tell important stories.

In addition to their pedagogical function, persona dolls also allow us to expand children's vocabulary. Children will hear new words and expressions from the educator to name feelings, ask for their meaning. Also, dolls can talk to children about educational content, about the topic of a project, or a topic that suddenly interests children.

Persona dolls are an excellent tactile, visual, and auditory stimulus for storytelling with children. Stories should be designed in such a way that they cover most of the problems that children face in kindergarten and at home, but in such a way that they have an open ending. The educator can introduce children to the story, giving them new information or confronting them with inaccurate information or prejudices that the doll has faced, and children should offer a range of possible solutions (Louge & Kim, 2011: 5). One of the goals for the development of speech that is achieved through storytelling with a puppet is to enrich vocabulary, especially in terms of words used to name emotions. We also expand and correct children's sentences and encourage children to speak in front of the group.

An expert in family pedagogy can be involved in telling stories about sensitive topics or family relationships, an ecologist can be involved in talking about environmental topics, etc. An expert can come to the kindergarten or can be involved via video call or phone call.

Guests who participate in the conversation with the doll can be selected to share characteristics with the person's doll (people with disabilities, people of another race or nationality, people with special needs, refugees from war-affected areas, etc; it is desirable to include consultants, such as people from the environment who have children with special needs or disabilities (Logue & Kim, 2011: 7).

Dušica Bojović's idea is interesting in that she proposes filming the doll in an area outside the kindergarten, to show children what the doll did on Saturday or Sunday in the park, in the countryside, or in the forest (https://dramskimetod.com/kako-upoznati-decu-s-lutkom/). Also, to introduce children to a problem situation, a teacher can show a printed photo of the doll in another setting, in a certain situation that is challenging. In addition, a video of a situation in which the doll found itself outside the kindergarten can be made to spark and stimulate a discussion in the group.

Stories about a doll to a person should be written down, citing the children's answers. They can be used to tell the story of the project, and writing them down in the form of a diary is also important because two or three educators work in one group, so all educators will have an insight into the flow of the story. Also, it is important to write down all the information about the identity of the doll (how many siblings there are, which child is in the family, what her parents do), because children remember all the details. A doll should never be put away in a bag or box; it is a member of the group and has its own place to sit or stand.

Cloth dolls can also be used for children to play in pairs, and the educator observes and listens to the topics that the dolls discuss. The dolls are placed next to each other in a corner of the room that is equipped with other props and toys for symbolic play (plastic fruits and vegetables, stuffed toys, wooden cubes, etc.), and children are encouraged to look at the dolls and take the one that is most similar to them. The doll that the children choose can play with other dolls. This allows us to observe how children choose friends.

Rag dolls can be an excellent stimulus for collective linguistic creativity, in the way that has been presented in the literature (Bozalek & Smit, 2014). After getting to know one doll person and hearing their story, the children are divided into smaller groups, and each group chooses one doll. The doll goes from hand to hand, and together they come up with her identity. They need to agree on how old the doll is, where she is from, where she lives (village/city, apartment/house), what language she speaks, who lives in her family, what kind of bed she sleeps in (sleeps alone in the bed, sleeps with her parents, shares a bed with her brother or sister, has a bunk bed, a sofa bed or a bed with a pull-out drawer), whether she has a disability or special needs, what she likes/dislikes (food, sports, cartoons, games, etc.), what she is afraid of, what has happened to her recently (she moved from another city, her parents divorced, a family member passed away, or they have a new addition to the family). Each group then presents its doll to the whole group of children. Each group then comes up with a story about their open-ended doll and presents it to the whole group, inviting them to offer possible solutions and continue the story. Within each small group, children talking to the doll can take turns. The educator writes down the stories,

and the stories about the dolls can be made up over and over again and repeated as long as the children want them to.

Persona Doll Approach in educational work in early childhood education - practical examples

The Persona Doll Approach was used in kindergarten in Jagodina, with 5-year-old children. Four stories were created by the teacher, based on the pedagogical issues present in the group:
"Taša Got a Younger Sister"
"Aleksei – New Friend in a Group"
"Ljubica Likes to Eat Sweets"
"Daniel – Roma Boy"

Taša Got a Younger Sister

Since there were many children in the educational group who had recently experienced a change in family dynamics with the loss of another family member, the first story addresses this shift and its impact on older siblings. Some children have had a difficult time separating from their parents and starting kindergarten. That is why they were visited by Tasha, a girl who is currently in the same situation. Tasha whispers in the teacher's ear that she worries that the parents will now only love the baby, and the teacher tells the children that she heard sadness in her voice.

The children then got involved, and a couple of them asked why she was sad. What worried Taša was that mom and dad would now only love and take care of the baby, and she would go to kindergarten. At that moment, all the children who already have a younger brother or sister began to say out loud that they also have a baby at home, not to worry, mom and dad will still love her, and she can even help mom with the baby. After the doll's story, the teacher invites the children to tell Taša why she should be happy and not sad. The following is the children's advice (translated into English):
"You can babysit while your mom drinks coffee."
"I'm making sure my brother doesn't fall off the bed while Mom is packing the room, so you can do that too."
"I wanted to throw my brother in a hole when he was born, but now I love him so much. He hugs me and kisses me and sometimes slobs me."
"You can all eat snacks together and watch TV in the evening. That's what mom, dad, brother, and I do."
"Not only will mom and dad look after the baby, but you will too."
"You can change her diaper."
"I asked my mom to give birth to my baby, and she said that she will do it tomorrow."

Aleksei – New Friend in a Group

Aleksei, a boy who recently arrived from Ukraine, has encountered challenges adapting to kindergarten. His peers are reluctant to engage with him due to his newcomer status and limited proficiency in Serbian.

Upon Aleksei's entry into the classroom, the children initiated the inquiries and shared their observations regarding his presence.

"Wow, how handsome he is!"

The teacher introduces Aleksei to the group and informs the children that he privately expresses his feelings of sadness. Drawing on their prior experience with the doll Tasha, the children promptly began suggesting possible solutions.
"It's so bad of those friends that they don't want to play with him."
"I want to play with him."
"Teacher, can we show him our room and toys?"
"I'd love to hang out with him."
"Maybe the kids would play with him if he put cream on his freckles."

The teacher emphasizes the importance of accepting new peers, regardless of their origin or language proficiency. He asks the children to consider ways they can support Aleksei to foster his sense of

belonging and emotional well-being. While seated beside Aleksei, the teacher offers reassurance through physical comfort. The children then propose various solutions.

“We can share toys with him.”
“We should kiss and cuddle him when he comes to kindergarten in the morning.”
“Let's give him a hand to come to us.”
“I'll tell my mom to buy him a cream to apply to freckles.”
The teacher explains that new classmates may exhibit shyness or reticence, and encourages the group to actively include them in play and share toys.
Then the children ask if Aleksei can play with them. He tells them that he can, of course, but they just need to come up with a game.
“He can draw with us.”
“And we can give him cubes, animals.”

They agree on a game and go to the table where Aleksei draws with the girls, and after that, he plays with the boys. The children helped him, added crayons and toys.

There are also two girls in the group who have recently joined and who have been withdrawn. They don't play with other children or sit on the sidelines. The story of Persona Doll helped them with adaptation and socialization within the group.

Ljubica Likes to eat Sweets

During the morning reception, on a walk, during performances, and similar events in kindergarten, five-year-olds join a group of four-year-olds. There is a chubby boy Kosta. When Kosta arrives at the kindergarten in the morning, the children in his group say that Bucko (‘Chubby’) has arrived. The five-year-old children heard this and commented, so the teacher decided to introduce them to Ljubica. Ljubica is a person doll who represents a cute, ruddy girl who likes to eat sweets and who is a bit chubby. When Ljubica entered our room and sat down in front of the children, the first question the children asked was:

“Why does she have such rosy cheeks?”

Ljubica whispered her name to the teacher and said that she was very ashamed and afraid; the teacher then passed this on to the children. The kids wanted to know why she felt that way. She whispered that it was because of her cheeks and stomach that the children were teasing her, so she was very sad and did not want to come to kindergarten. Then the children began talking emphatically:
“She is so cute with rosy cheeks.”
“So what, I like sweets too.”
Ljubica then whispered that her friends also like to eat sweets, but they only laugh when she eats.
“My mom told me that it doesn't matter what we look like; the important thing is that we are healthy and that we are good people.”
“I want to play with her, not laugh at her.”
“It’s not nice for your friends to laugh at you, tell them.”
Ljubica whispered that she told her friends, but that they were still laughing and saying that they wouldn't share sweets with her.
“Then let Ljubica stay with us, we will share a snack with her, and we will play with her.”
“Teachers, please let Ljubica stay with us until the snack, we will give her a snack.”
“All her friends are to give her a snack because she is hungry, not to laugh at her.”
“I don't like to eat, let Ljubica eat my snack.”
I ask the children how we can help Ljubica. What do you have to do to make sure you don't feel sad?
“Don’t call her Chubby like Kosta.”
“I'm saying that my friends say that Ljubica is a buck and that’s what they call her, and that’s not nice.”
“It's not nice, that's why she’s going to cry.”
“Maybe she won't, Kosta isn’t crying.”
“I’m going to go and tell Kosta’s friends not to call him that anymore.”

Daniel – Roma Boy

Daniel is a boy who comes from a Roma family. Because of their darker skin, children are prejudiced and don't want to play with him. When Daniel joined the group and sat down on the carpet, the children sat around him, watching him and waiting for him to tell them what was bothering the new boy. She told them that she would find out from him.

Daniel quietly, shyly told the teacher his name and told her that his friends avoided him in kindergarten because he had darker skin.

“So what, maybe he went to the sea.”
“I think he painted his face with some cream.”
“No, he's a gypsy.”
Then the teacher turned to Daniel and allowed him to tell how he felt. He whispered that many call him a gypsy and that he is sad about it. Then one little girl said, 'It doesn't matter what we look like, we all have to play.' The others joined in:
“He may not have bathed, that's why his skin is like that.”
“You have taken a bath, smell his hair.”
“Teacher, what if he is a gypsy?”
A kindergarten teacher asks the children: “How can we help Daniel?”
“We can go to his friends and tell them they’re rude.”
“We'll give him toys and he'll say he's found some friends.”
“Let him join our group.”
“Let’s play with him all day, and he'll be happy.”
“He can play with his friends afterwards, the same thing he played with us.”
“Let's ask Daniel what he likes to play with the most.”
“Daniel tells me that he likes to draw and play with animals and to make a zoo.”
Then everyone asks to play with Daniel. The educator asked him if he wanted to, and he told the children that Daniel was very happy to be invited to play.
The teacher asks the children what else they can do to make Daniel feel better.
“We can hug him.”
“And kiss him.”
“We can call him on his birthday.”
At that moment, a boy walked up to Daniel, stroked his arm, and said, “Don't worry, we’ll play with you.”

Pedagogical values of using persona dolls in the educational work in early childhood education

Education of preschool-aged children requires an exceptionally creative and original approach, where professionally trained educators play an important role in fostering creative expression and developing critical thinking skills in children during their early developmental period (Ata-Akturk & Sevimli-Celik, 2023). As the connection between children’s play and the development of creativity in their lives is strong and supported by common goals for child development, we first point out the importance of play.

Taking into account the fact that „the game is a fundamental activity of the child and represents the main maturing process, mental and emotional development” (Lăzărescu & Pîrvulescu, 2019: 1441), it is the leading and primary activity in children’s lives, both in the family environment and in the context of institutional upbringing and education. When talking about games, it is essential to mention toys, which represent „the material element of the game, which influences its flow and content with its properties” (Kamenov, 1995: 411), which indicates that they are an integral part of the game and contribute to the further development and continuation of the process. The role of adults in this complex process is that „they can sometimes teach, facilitate, encourage, but ultimately it is the child’s activity that drives development” (Kamenov, 1995: 416). This indicates that it is necessary for both educators and parents to be aware of their role in the process of children’s play, because „intervention should not disrupt the characteristics of play in the use of the materials provided” (Kamenov, 1995: 416). According to this, the results of the study show that parents have a very positive attitude towards children’s play and recognise its educational value (Milanović, 2024a). The results of this empirical research show that teachers also have a positive attitude towards children’s play, recognising its role in children’s lives (Milanović, 2024a). Furthermore, the findings show that although parents believe they know how to

recognise the play that their child needs, from the teacher's perspective, the calculated value is lower (Milanović, 2024a). In the context of the findings presented, the results of empirical research (Milanović, 2024b) show that teachers, through their collaboration with parents, are not sufficiently engaged in pointing out to parents the advantages and disadvantages that play has in child development. Based on some of the findings of the research, a question arises about the different possibilities of children's play, the use of toys, cooperation between families and educational institutions, in which the use of puppets can have significant potential in the context of the harmonious development of children; we must not forget that „without games and toys, children's reality would be dull and empty" (Kamenov, 1995: 411).

Accordingly, the presence and use of toys in a pedagogical sense represents a link between play, learning, and overall development of children, whereby the use of toys does not only imply an entertaining context, but also brings with it a number of benefits that are reflected in many areas of development (Kröger & Nupponen, 2019). „The use of puppets in educational work allows children to express all their inclinations, develop speech, and play a positive image of themselves" (Milivojčević & Grčić, 2017: 47). Analysing the literature, the authors point to possible ways of using puppets in the process of upbringing and education (Kröger & Nupponen, 2019). „The potential uses are (1) generating communication, (2) supporting positive classroom climate, (3) enhancing creativity, (4) fostering co-operation in and integration into a group, and (5) changing attitudes" (Kröger & Nupponen, 2019: 399). Thus, we expect that the potential uses of puppetry in the context of education and training are very broad, which opens up opportunities for practitioners to use them more often in their work with children and to make this process interactive and enjoyable. Taking into account the fact that „puppetry is a form of theatre or performance that involves the manipulation of puppets" (Kröger & Nupponen, 2019: 393), from a pedagogical perspective, „children's theatre games engage all of a child's abilities and have a positive impact on their overall development:
– develop speech;
– rich social relationships;
– develop empathy;
– discipline;
– responsibility;
– free them from the egocentrism that is characteristic of preschool age;
– encourage perseverance;
– develop thinking and enable them to acquire moral norms;
– stimulate creativity and inventiveness" (Milivojčević & Grčić, 2017: 47).

From the point of view of the above, we come to the question about the pedagogical possibilities and importance of persona dolls, whereby we will point out the values and benefits of the application of persona dolls in pedagogical work with children who hide the spectrum of well-being and have the potential for many positive outcomes. Starting from the approach (Logue & Kim, 2011) we will point to some values of including persona dolls in the process of raising and working with preschool children: first of all, some of the benefits reflect the potential activity and involvement of the child, since these dolls are made by hand, it is possible to involve children in the creation of the doll, through the use of recycled and available materials, which contributes to the development of Nature Conservation and the development of aesthetic component of upbringing in children, as well as the development of fine motor skills, which also encourages imagination, authenticity and innovative expression; through socializing and relationships with the doll, children develop social and communication skills, providing help and finding various solutions to given situations and tasks while focusing on promoting and developing moral and prosocial behavior; they contribute to understanding and acceptance of diversity in different spheres, as well as to the development of multicultural education; they also contribute to the aspect of recognition and expression of thoughts and emotions in children and in general its role, application and value the overall development of the child's personality. „Accordind to the findings of the research, the values education program supported by the Persona Dolls Approach had a positive effect on the attainment of social values in the children and this effect was permanent" (Duran Yılmaz & Ömeroğlu, 2024: 754). Therefore, once again we can point out its important role and widespread application in working with children.

In other words, „a puppet is a metaphor for children's games that establish a wonderful connection with childhood and dreams" (Šimunov, 2008: 84) and therefore, based on everything presented, we can conclude that the pedagogical value of using and incorporating persona dolls through play in educational work with children are obvious and numerous. This further emphasizes the need for educators to point out the possibilities of using play in the family environment, which would contribute to improving the relationship between the family and the preschool institution, as well as contemporary concepts and issues.

Discussion, Conclusion, and Suggestions

Based on the presented examples, which describe the use of persona dolls, we notice that there are several possibilities and situations in which educators can incorporate them and utilize their potential in preschool. From the example of a new family member's arrival, we notice that the educator recognized these circumstances in the educational group and included persona dolls to help participants deal with this situation. Children share their own observations and emotions that they have encountered in a similar situation, and help Tasha cheer up. So, the children's answers indicate that they were in a similar situation, but we can see that their parents were committed to accepting and bringing a new member. It is especially important that the educator recognizes the current situations that are happening with children in the group and uses the opportunity to help children overcome certain challenges more easily with a creative approach, which contributes to the development of empathy, reflection, and cooperative action in children. In the examples of Ljubica, Daniel, and Aleksei, the focus is on accepting diversity. „It's not enough to just listen informal lectures on values. To adopt values, they must experience them on many different levels and must develop the social skills they need to use values on a daily basis" (Tilman & Hsu, 2007: 9). Viewed from a pedagogical perspective, these examples contribute to the development of acceptance and appreciation of diversity in children, as well as the development of multicultural upbringing. An interactive and original approach, with the use of persona dolls, contributes to children looking at diversity positively, while contributing to the creation of a more humane and healthy society. Through the use of persona dolls, the preschool teacher sends a message to children that diversity should be viewed through the prism of respect, appreciation, and understanding, and the educational environment in a preschool institution is an ideal and suitable environment where children adopt these values and behaviors. The children's interest in the doll Tasha grew, which indicates that the children asked her about Tasha every day. Bearing in mind that grandparents are participants, but also an important part of growing up (Vilotijević, 2002; Milanović, 2024), the educator used the example in which Taša traveled to her grandparents. Taša shared with the children her impressions of how she had a great time at her grandmother's and grandfather's, pointing out that in addition to enjoying herself, she also helped with the winter food. It is important to point out that „the child's independence in satisfying personal needs, getting him used to self-service and engaging him to help around the house and perform part of his household duties, are the way to form permanent and solid work habits" (Trnavac & Đorđević, 2013: 102). Therefore, this example sends a message that children should be involved in certain household activities, because they contribute to the development of work education in children. In the story of Ljubica and Daniel, we come across a positive example that was presented to the children, which concerns mutual companionship and friendship. In this story, Ljubica and Daniel are portrayed as happy actors and best friends who feel comfortable, positive, and accepted. The example of Aleksei was used by the teacher in the direction of promoting a clean and healthy environment, whereby it is necessary to raise awareness of these topics in children. „The role of preschool institutions and educators is to enable the child to emotionally experience nature, to develop love for all living beings, to get to know nature with all his senses, to feel comfortable when he is in nature, and to experience nature as part of his environment" (Stanišić, Đević & Đerić, 2010: 250). In accordance with the above, this example indicates and contributes to the environmental awareness of children and the development of environmental education. Finally, it is necessary to point out that „we need to organize such educational conditions in which we will prevent socially unacceptable moral phenomena, and gradually form firm attitudes in children about honesty, sincerity, fairness, truthfulness, respect for the personality of others, and the like" (Trnavac & Đorđević, 2013: 102), whereby the application of persona dolls can be of great importance in this process.

Examples from educational work with preschool-aged children show the possibilities of using the Persona Doll Approach in order to promote pedagogical values. The children were more involved,

curious, and they were willing to express their emotions and thoughts, and they had empathetic responses to the doll's stories. Although persona dolls are usually used in kindergarten, they can be a powerful tool for promoting pedagogical values in primary school. The Persona Doll Approach should be implemented in homeroom lessons with younger students, because „modern schools are crying out for new methods to encourage students to think about empathy" (Štimac & Rupčić Kelam, 2023: 138).

Through examples of good practice, we pointed to pedagogical benefits and values that contribute to children's development, because in this way a lot is achieved in the progress of children through an original, innovative, imaginative, and dynamic approach with primary representation and socializing with persona dolls.

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The Investigation of the Relationship Between Life Satisfaction and Psychological Resilience Levels Among Teacher Candidates

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Abstract

This study aims to investigate the relationship between life satisfaction and psychological resilience levels among teacher candidates. A correlational survey model was used in the study. The study participants were 180 teacher candidates enrolled in the Special Education Department of the Faculty of Education at Trakya University during the 2024-2025 academic year. The Life Satisfaction Scale, developed by Diener et al. (1985) and adapted into Turkish by Dağlı and Baysal (2016), and the Adult Psychological Resilience Scale, developed by Arslan (2020), were used to collect research data. According to the research results, life satisfaction levels of special education teacher candidates significantly differed by gender, with female candidates showing higher levels. It was observed that the psychological resilience levels of special education teacher candidates did not differ considerably in terms of the gender variable. A positive relationship was observed between Life Satisfaction and Psychological Resilience Levels.

Keywords: Teacher Candidate Life Satisfaction, Psychological Resilience, Positive Psychology, Teacher Training Programmes

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Introduction

Life satisfaction is defined as the difference between what a person achieves in life and what they desire (Özer and Karabulut, 2003). Life satisfaction is influenced by the individual's past, present and future life changes and by the views of people in their immediate environment regarding their life. The areas of satisfaction for an individual are their job, free time, family, self-perception, income, health, and the people in their immediate environment (Diener et al., 1999). Furthermore, according to Myers and Diener (1995), life satisfaction is influenced more by psychological variables (individual characteristics) than by variables such as gender and economic status. Teaching is a challenging profession, and high life satisfaction is a desirable trait in teachers (Deneme, 2021). It is important for teachers to have good mental health because they are in close contact with all segments of society, especially their students (Demir & Murat, 2017). Furthermore, since life satisfaction is formed as a result of an individual's assessment of their life as a whole, a teacher who is happy in their general life is likely to be happy in their teaching profession as well (Türker & Çelik, 2019). In other words, teachers, who are responsible for shaping their students in all areas of life, will undoubtedly have a primary impact on their students. From this perspective, it is of great importance that teachers, who have such an impact on students in particular across all segments of society, have good mental health (Yavuz & Ilgaz, 2024).The concept of resilience originates from the Latin root ‘resiliens’. In terms of meaning, this concept, used in mathematics and physics, refers to a material returning to its original state after undergoing a change (Greene, 2002). Psychological resilience is defined as a person's ability to cope with stress, trauma, and adverse life conditions and to emerge stronger after facing difficulties (Özer and Deniz, 2014). According to Block and Kremen (1996), psychological resilience is an individual's ability to adapt and cope with adverse events. Studies have shown that psychological resilience protects against anxiety (Yakıcı and Kandemir, 2021) and depression (Chen et al., 2023). In addition, individuals with high levels of psychological resilience are seen to be good-tempered (Tschann et al., 1996), positive about life (Floyd, 1996), have strong family ties (Carbonell et al., 1998), and are determined and patient (Smokowski et al., 1999). Furthermore, psychological resilience also contributes positively to life satisfaction (Mao et al., 2023).A review of the literature reveals a limited number of studies examining the psychological resilience levels of special education teacher candidates (Traş et al., 2025). Furthermore, studies examining the psychological resilience levels of education faculty students have been found (Eroğlu, 2020; Hoşoğlu et al., 2018; Özkan, 2017). A review of the literature reveals no studies examining the life satisfaction levels of teacher candidates. However, studies have been conducted with students in training programmes (Demir & Murat, 2017) and education faculty students (Çalışandemir & Baltacı, 2017; Gül & Alimbekov, 2020). A review of the literature reveals studies examining the life satisfaction levels and psychological resilience levels of special education teacher candidates. However, there are only a limited number of studies examining the life satisfaction levels and psychological resilience levels of teacher candidates (Akdeniz et al., 2021; Tras et al., 2021).

Importance

Both psychological resilience and life satisfaction levels of special education teacher candidates affect teaching quality and their decision to continue in the profession during their professional development process. From this perspective, examining the relationship between teacher candidates' psychological resilience and life satisfaction levels is considered important from both an individual and institutional perspective. Furthermore, no research has been found examining the psychological resilience and life satisfaction levels of special education teacher candidates. This research is also expected to contribute to the literature in this regard. A review of the literature reveals that positive psychology theories indicate a positive relationship between psychological resilience and life satisfaction (Mao et al., 2023).Therefore, it is thought that the results of this research, by presenting findings that support this theory, will shape the professional motivation of special education teacher candidates and their ability to communicate effectively with individuals with special needs. This research will enable the development of intervention programmes aimed at increasing psychological resilience and life satisfaction in teacher training programmes. Furthermore, it is considered important in terms of developing data-based recommendations for organising counselling services in education faculties and improving the professional preparation processes of teacher candidates. For this reason, this study aims

to examine the relationship between teacher candidates' life satisfaction and psychological resilience levels. Furthermore, answers were sought to the following questions:

1. Do the life satisfaction levels of special education teacher candidates differ in terms of the gender variable?
2. Do the psychological resilience levels of special education teacher candidates differ in terms of the gender variable?
3. Is there a relationship between the life satisfaction and psychological resilience levels of special education teacher candidates?

Method

This section covers the research model, participants and implementation process, data collection tools, and data analysis.Research ModelThis study aimed to examine the relationship between teacher candidates' life satisfaction and psychological resilience levels. Therefore, a correlational survey model was used in this study. The correlational survey model is a research model that aims to determine the existence and/or degree of co-variation between two or more variables (Karasar, 2012).

Participants and Implementation Process

The participants in the study consisted of adult individuals studying in the Special Education Department of the Faculty of Education at Trakya University. The scales were administered by the researchers during the course after obtaining the necessary permissions from the relevant university's ethics committee. Written informed consent was obtained from participants who volunteered to participate in the study. The descriptive statistical information of the participants is presented in Table 1..

Table 1.

Descriptive Statistical Information of Participants

Variable	Category	*f*	%
Gender	Woman	96	53.3
	Man	84	46.7
Class	1	48	26.7
	2	41	22.8
	3	53	29.4
	4	38	21.1
Did you choose the special education department deliberately?	Yes	152	84.4
	No	28	15.6

Table 1 shows that a total of 180 special education department students participated in the study. Looking at the gender distribution of the participants, 53.3% (n = 96) of the sample were female and 46.7% (n = 84) were male.

Looking at the distribution by class level, 29.4% (n = 53) of participants were third-year students, 26.7% (n = 48) were first-year students, 22.8% (n = 41) were second-year students, and 21.1% (n = 38) were fourth-year students. This distribution indicates that the sample is balanced across different class levels.

When asked whether they had chosen the special education department voluntarily, 84.4% (n = 152) stated that they had chosen this department voluntarily, while 15.6% (n = 28) stated that they had been placed in this department involuntarily. This finding indicates that the vast majority of students have a voluntary orientation in their section preferences.

Data Collection Tools

The Demographic Information Form, Life Satisfaction Scale, and Adult Psychological Resilience Scale were used to collect data.

Demographic Information Form

The demographic information form developed by the researchers included questions about the participants' classes and gender.

Life Satisfaction Scale

The scale was developed by Diener et al. (1985) and adapted into Turkish by Dağlı and Baysal (2016). The scale has a unidimensional structure. It consists of a total of 5 items. Structured according to a five-point Likert-type rating system, the scale allows for scoring between 1 (Strongly disagree) and 5 (Strongly agree) for each item. In the adaptation study, the scale's internal consistency coefficient (Cronbach's α) was calculated as .88. This value indicates that the scale is highly reliable. Furthermore, the test-retest method, applied at two-week intervals, yielded a correlation coefficient of r = .97, demonstrating that the scale is highly consistent over time.

Adult Psychological Resilience Scale

The scale, developed by Arslan (2020), has a 5-point Likert rating system (1 = Does not describe me at all, 5 = Describes me completely). It consists of a total of 21 items and 4 sub-dimensions (relational resources, familial resources, individual resources, and cultural and contextual resources). Scores on the scale range from 21 to 105, with higher scores indicating a higher level of psychological resilience. Scores for the scale's subscales can be calculated separately, allowing for the identification of individuals' strengths and weaknesses in specific dimensions of psychological resilience. The Cronbach's alpha coefficient for the scale's internal consistency was found to be .94. The reliability coefficients of the subscales are also high. The test-retest reliability coefficient of the scale was calculated as .85, indicating that the scale provides consistent measurements over time.

Data Analysis

The data obtained from the data collection tools were analysed using the SPSS 26.00 for Windows package programme. The normality of the variables was determined based on their kurtosis and skewness values. The values obtained are presented in Table 2, and it was determined that these values were within the range required for normal distribution (George & Mallery, 2010; Huck, 2012). Therefore, the T-test was used for pairwise comparisons, and the Pearson Moment Product Correlation Coefficient was used to determine the direction and level of the relationship. The Pearson Product-Moment Correlation Coefficient is calculated when there is a linear relationship between data obtained from two variables belonging to an individual or object, when the variables are continuous data types, and when it is assumed that the feature of interest is normally distributed in the universe (Baykul, 1999). α=0.05 was selected for the significance level.

Findings

Descriptive Statistics

Table 2.

Descriptive Statistics

	Mean	*SD*	*Skewness*	*Kurtosis*	*Cronbach's α*
Life satisfaction scale	14.51	3.68	.00	-.02	**.85**
Psychological resilience scale	79.15	12.64	-.44	.28	**.90**
Relational resources	22.27	4.04	-.28	.45	**.77**
Family resources	19.32	3.87	-.65	.32	**.83**
Individual resources	19.36	3.23	-.58	.67	**.80**
Cultural and contextual resources	**18.19**	**4.16**	**-.63**	**.22**	**.74**

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Descriptive statistical findings regarding the variables used in the study are presented in Table 2. Accordingly, the mean score on the Life Satisfaction Scale was found to be 14.51 (SD = 3.68), and the scale's internal consistency coefficient demonstrated a high level of reliability (Cronbach's α = .85). The distribution of the scale is quite close to normal distribution, with skewness (Skewness = .00) and kurtosis (Kurtosis = –.02) values within the ±1 range.

The mean total score for the Psychological Resilience Scale was determined to be 79.15 (SD = 12.64), and the scale's internal consistency is very high (α = .90). The skewness value for the scale is –.44 and the kurtosis value is .28, which supports the scale's normal distribution.

When examining the sub-dimensions of psychological resilience:

- The mean for the Relational Resources sub-dimension is 22.27 (SD = 4.04), with reliability α = .77
- The mean for the Family Resources sub-dimension was 19.32 (SD = 3.87), with reliability α = .83
- The mean for the Individual Resources sub-dimension was 19.36 (SD = 3.23), with reliability α = .80
- The mean for Cultural and Contextual Resources was 18.19 (SD = 4.16), with reliability α = .74.

All Cronbach's alpha coefficients for the subscales were above .70, indicating that the scales have acceptable levels of internal consistency.

The fact that the skewness and kurtosis values for all variables fall within the ±1 range indicates that the data set is suitable for parametric tests and that the variables meet the assumption of normal distribution.

Table 3

T-Test Results for Scores Obtained from the Life Satisfaction Scale and Psychological Resilience Scale by Gender

	Gender	*N*	*X*	*S*	*Sd*	*T*	*P*
Life satisfaction scale	Woman	96	15.20	3.45	178	2.737	.007
	Man	84	13.72	3.80			
Psychological resilience scale	Woman	96	80.66	11.50	178	1.724	.087
	Man	84	77.42	13.70			

Table 3 shows that the scores obtained from the Life Satisfaction Scale differ significantly according to gender. Female participants ($\bar{X}$ = 15.20, SS = 3.45) reported higher life satisfaction compared to male participants ($\bar{X}$ = 13.72, SS = 3.80). The independent samples t-test found this difference to be statistically significant (t(178) = 2.737, p = .007). This finding indicates that female students have higher overall life satisfaction levels than male students.

The analysis results regarding Psychological Resilience Scale scores revealed that female participants ($\bar{X}$ = 80.66, SS = 11.50) had higher average scores than male participants ($\bar{X}$ = 77.42, SS = 13.70), but this difference was not statistically significant (t(178) = 1.724, p = .087). This result indicates that gender does not have a significant effect on psychological resilience levels, but that women's psychological resilience scores tend to be slightly higher than men's.

Table 4

The Relationship Between Life Satisfaction and Psychological Resilience

	1	**2**	**3**	**4**	**5**	**6**
Life satisfaction scale	-					

Psychological resilience scale	.410**					
Relational resources	.424**	.881**				
Family resources	.436**	.863**	.697**			
Individual resources	.299**	.803**	.734**	.596**		
Cultural and contextual resources	.196**	.756**	.487**	.553**	.397**	-

**p <.001

Table 4 reveals a positive and significant relationship between life satisfaction and psychological resilience (r = .410, p < .01). This finding indicates that individuals who are more psychologically resilient derive a higher level of satisfaction from their lives. Furthermore, significant and positive relationships were also found between life satisfaction and the sub-dimensions of psychological resilience. Life satisfaction was positively correlated with relational resources (r = .424, p < .01), familial resources (r = .436, p < .01), individual resources (r = .299, p < .01), and cultural and contextual resources (r = .196, p < .01).

These findings reveal that individuals' levels of life satisfaction are strongly related not only to individual characteristics and personal resources, but also to social relationships, family support, and cultural or contextual factors. Overall, it can be concluded that increased levels of psychological resilience positively affect life satisfaction and that relational and familial support, in particular, play a decisive role in this process.

Discussion and Interpretation

According to the results of this study, it was observed that the life satisfaction levels of special education teachers were higher among female students than male students in terms of the gender variable. When reviewing the literature, we found a study conducted with university students that was parallel to the findings of this study (Tras et al., 2021). However, findings differing from those of this study have also been encountered. A review of the literature reveals that Gül & Alimbekov (2020) and Karabaş (2018) observed no difference in the life satisfaction levels of teacher candidates in terms of the gender variable in their studies. According to this research result, the reason why female students' life satisfaction levels were observed to be high may be due to female students' more compliant classroom behaviour, communication-focused approach, and openness to cooperation with teachers (Eratay et al., 2015). This situation may have increased the life satisfaction levels of teacher candidates by reducing their stress levels.

According to the results of this study, it was observed that the psychological resilience levels of special education teachers did not differ significantly in terms of gender. Conflicting findings are encountered in the literature review. Tras et al. (2021) observed higher levels of psychological resilience in female teacher candidates in their study. Aydın et al. (2019) and Hoşoğlu et al. (2018) observed that male teacher candidates had higher levels of psychological resilience than female teacher candidates in their studies. According to the results of this study, the reason why psychological resilience levels do not differ in terms of gender may be that the individual needs of students in special education environments can be more decisive than their gender. For this reason, teacher candidates may encounter similar levels of stress regardless of gender and develop similar coping strategies.

According to the results of this study, a significant relationship was observed between life satisfaction and psychological resilience. Looking at the literature, there are studies conducted with teacher candidates that are parallel to the findings of this study (Akdeniz et al., 2021; Tras et al., 2021). In addition, studies conducted with teachers report a positive relationship between life satisfaction and psychological resilience (Gampala, 2024; Khan et al., 2023). These research findings reveal a positive and significant relationship between the life satisfaction and psychological resilience levels of special education teachers. This result shows that the ability of teacher candidates/teachers to cope with the stress and problems they encounter in their professional lives directly affects their overall life satisfaction. Psychological resilience is defined as an individual's capacity to demonstrate flexibility and adaptability in the face of stressful life events (Block and Kremen, 1996). In professions with high emotional demands, such as teaching, this capacity can function as a protective variable that increases life satisfaction.

Limitations

This study is limited to 180 teacher candidates enrolled in the Special Education Department of the Faculty of Education at Trakya University during the 2024–2025 academic year. Therefore, the fact that the sample is limited to a single university and the data is obtained from only one department limits the generalisability of the findings. Furthermore, the data was collected solely through self-reporting, and the possibility of social desirability bias in participants' responses should be considered. Although the scales used in the study are effective in measuring individuals' life satisfaction and psychological resilience levels, the lack of longitudinal data can be considered a significant limitation given the dynamic nature of these variables. Finally, factors other than gender, such as socioeconomic status, academic achievement, and family structure, were not controlled for, which prevented a more in-depth examination of the relationships.

Recommendations

In line with the research findings, it is recommended that intervention programmes aimed at increasing the life satisfaction and psychological resilience levels of special education teacher candidates be integrated into the teacher training process. Strengthening counselling and psychological counselling services in education faculties may improve teacher candidates' ability to cope with occupational stress. Future research involving larger samples from different universities and departments will increase the generalisability of the findings. Furthermore, an in-depth examination of teacher candidates' life satisfaction and psychological resilience experiences using qualitative methods could enrich the theoretical contribution. Longitudinal studies tracking the change in these two variables over time could assess their effects on the transition to the teaching profession. Finally, including variables such as socioeconomic status, academic achievement, and family support in the model would provide a more comprehensive understanding.

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Pedagogical Use of Artificial Intelligence Tools in Foreign Language Learning Advising: A Case Study

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Abstract

Contemporary technological advancements necessitate the adoption of new methods and tools in foreign language education. In particular, artificial intelligence provides personalized and effective support by being integrated into learning processes. This study aims to examine the pedagogically appropriate and conscious integration of AI tools into foreign language learning advising and its potential effects. In this context, it investigates how AI supports personalized learning pathways and adds value to traditional advising approaches. The research is designed as a qualitative case study based on three advising sessions conducted within the course "Learning Advising and Coaching in Language Education II," offered in the Master's Program in German Language Education at Trakya University. The participant consists of a volunteer third-year student from the German Language Teaching Department at Trakya University. The student was included in the advising process due to specific challenges encountered in developing German writing skills. During the advising sessions, AI tools were employed in a structured and controlled manner within the advising framework to develop strategies aimed at addressing the student's writing difficulties. These tools were integrated to assist the student in analyzing errors, practicing writing, and improving time management skills. Data were collected through transcriptions of audio recordings from the sessions, detailed observations, and both verbal evaluations conducted during the sessions and written evaluations obtained after the sessions. While the observations focused on the student's interaction with AI tools, learning motivation, and progress throughout the advising process, the evaluations revealed both the advisor's and the student's perceptions and levels of satisfaction. The positive feedback from both the advisor and the student, along with their high motivation throughout the process, indicates that AI-supported advising is effective and sustainable. This indicates that AI-supported advising can offer effective and sustainable support in foreign language learning processes. The study reveals that the conscious and goal-oriented integration of AI technologies into language learning advising can contribute meaningfully to autonomous learning approaches in the digital age. It is also anticipated that such integration may enable learners to define their own learning paths and develop more effective learning strategies.

Keywords: Foreign language education, learning advising, artificial intelligence, pedagogical integration, case study.

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Introduction

In our era of accelerating digitalization, educational processes are undergoing significant transformation. One of the most striking aspects of this transformation is the innovative opportunities that AI (artificial intelligence) offers for foreign language teaching. According to Yunina (2023), AI-Tools can offer personalized learning paths by taking into account the individual differences of learners. Thus, adaptable content is developed according to students' needs and abilities, making the learning process more flexible and efficient. In particular, the possibility of instant feedback and customized support increases learners' motivation and encourages their more active participation in the process (Arslan, 2020; Poleshchuk and Schatz, 2024). In this context, it is stated that AI not only accelerates foreign language learning but also offers a more in-depth and lasting learning experience (Butarbutar, 2024; Tuğlu, 2024).

Foreign language learning requires learners not only to acquire linguistic knowledge but also to manage their own learning process, develop strategies, and effectively use self-regulation skills. Therefore, the concept of autonomous learning stands out as a fundamental goal in contemporary foreign language teaching. Holec (1981: 3) defines autonomy as the learner's ability to take responsibility for their own learning. Little (1991: 4), on the other hand, views the concept of autonomy as the learner's independence. Based on these definitions, autonomous learning may require the learner to make decisions about their own learning process. However, autonomy does not mean leaving the learner completely unsupported; on the contrary, guidance, direction, and strategy development support in the learning process play a critical role in the sustainable development of autonomy. Furthermore, not every learner is competent enough to organize their own learning process independently and may often need external support (Claußen, 2008: 7). At this point, foreign language learning counseling comes into play, providing learners with support in structuring their own learning paths, decision-making processes, and achieving learning goals (Tassinari, 2022: 35). According to Mehlhorn and Kleppin (2006: 1), the aim of language learning counseling is to support learners in a variety of learning environments (e.g., tandem language learning, individual learning centers, distance learning), encourage them to take responsibility for their own learning processes, and find effective learning paths for them.

Kopp and Mandl (2011) point to online learning as one of the reasons why autonomous learning is becoming increasingly important and draw attention to collaborative, self-disciplined learning with new media tools. This observation indicates that foreign language learning counseling needs to be reevaluated in a digital context. Indeed, the increasing integration of AI tools into online learning environments today, and their preference by the new generation in particular, can add new dimensions to counseling processes. AI can not only provide adaptive content that takes into account learners' individual differences, but also serve as a strategic tool in developing learning strategies. With its capabilities to provide instant feedback, diversify learning paths, and offer recommendations tailored to personal learning goals, AI can play a significant role in supporting learners' self-regulation skills and contributing to the sustainable development of autonomous learning. Therefore, the pedagogical integration of AI with language learning counseling can contribute to both strengthening learners' strategic learning approaches and providing a more effective, lasting, and personalized learning experience in foreign language learning.

Literature Review

German Learning Strategies

The foreign language learning process requires learners to discover their own learning paths and use strategies that guide how learning takes place. Weinstein & Mayer (1983) define learning strategies as behaviors and thoughts that learners resort to and that aim to influence the process of processing and making sense of information in the mind and transferring it to long-term memory. Similarly, Bimmel and Rampillon (2000: 51) express learning strategies as *"a mental action plan to achieve a learning goal."* In foreign language learning, strategies are considered a fundamental component of contemporary language learning because they are active, self-directed participation tools and contribute to the development of communicative competence (Oxford, 1990).

Foreign language learning strategies have been classified in various ways by different researchers in the literature (see Ballweg et al., 2013; Bimmel & Rampillon, 2000; O'Malley & Chamot, 1990; Oxford,

1990). According to the classification by Ballweg et al. (2013), which adds a new dimension to foreign language learning strategies, strategies are divided into four main categories: (1) cognitive, (2) metacognitive, (3) affective, and (4) communicative strategies.

- Cognitive strategies can be defined as mental actions that lead to the acquisition, processing, and storage of knowledge and facts, and their recall when needed (Ballweg et al., 2013; Friedrich & Mandl, 2006). Within this framework, examples of cognitive strategies include using picture cards to learn vocabulary, repeating, or highlighting key words in a text.
- Flavell (1979) explains metacognition as an individual's awareness of their own cognitive processes and monitoring of these processes. In this context, metacognitive strategies are related to the learner organizing their own learning process through planning, monitoring, and evaluation.
- Affective strategies are related to emotions and motivation (Ballweg et al., 2013: 96). According to Leopold (2009: 56), this category includes strategies such as focusing attention, increasing concentration or motivation, and reducing test anxiety.
- Communication strategies reveal that language is not only about learning but also about using language (Ballweg et al., 2013: 96). Examples of communication strategies include using gestures and facial expressions or substituting a new word for one that cannot be remembered.

The definitions and examples presented above show that foreign language learning strategies cover a wide range of functions in the learning process. Therefore, it is crucial for individuals to recognize existing strategies so that they can choose the strategies best suited to their learning needs and apply them consciously.

Bimmel and Rampillon (2000) emphasize that while it is not possible for every learner to master all strategies, it is essential to provide a learning environment where they can be exposed to and experience as many strategies as possible. In this regard, strategy training (Ballweg et al., 2013: 100), which enables learners to systematically identify different strategies and find opportunities to apply them, plays a central role in language learning. Such a process supports not only the theoretical understanding of strategies but also their integration into individual learning practices. Within this framework, foreign language learning counseling provides a guiding and supportive environment for learners to identify, apply, and develop the most appropriate strategies for them, taking into account their individual differences. In this respect, learning counseling contributes to the effective implementation of strategy training.

The Role of Learning Strategies in German Language Learning Advising

Foreign language learnig advising enables learners to gain awareness of their own learning processes, allowing them to develop a more autonomous approach to learning. Learning advising encourages learners to reflect on their learning processes and develop autonomy, enabling more sustainable progress (Beer et al., 2022; Chromcak, 2008).

In this context, learning strategies are one of the fundamental elements at the heart of advising Strategies contribute to learners planning, organizing, and making their language learning processes more effective. Rösler (2012: 123) states that strategy training can be meaningfully complemented by individual learning counseling. Particularly in the process of learning German as a foreign language, learners need to consciously apply not only linguistic content but also the learning strategies that support this content. This increases cognitive awareness, enables learners to select and apply strategies appropriate to their needs, and provides them with guidance in planning, monitoring, and evaluating their learning processes.

Today, with digitalization, AI tools are adding new dimensions to foreign language learning counseling. Especially in German teaching, AI-powered applications such as ChatGPT enable learners to discover and customize strategies tailored to their individual learning profiles. Learners have the opportunity to receive real-time guidance and structured feedback while working on specific grammar structures or thematic vocabulary areas, which increases the effectiveness of strategy use.

Consequently, counseling practices supported by learning strategies in German teaching develop individual learning awareness and make learning processes more planned, effective, and autonomous.

Strategic Use of Artificial Intelligence Tools in German Language Learning Advising

As a digital tool with the potential to transform learning processes, AI can provide strategic support in learning a structurally complex language such as German. Pokorni et al. (2021), while defining AI as a branch of computer science, emphasize its capacity to model and mimic complex cognitive functions unique to human intelligence. In this context, AI is considered not only a technical system but also a cognitive partner that can be integrated into learning processes.

Although AI tools cannot achieve learning on their own, they contribute significantly to the development of learning strategies through functions such as providing personalized guidance, giving instant feedback, performing error analysis, and increasing learning motivation (Hashemifardnia & Kooti, 2025; Liang et al., 2023; Wu et al., 2024). These functions facilitate more active and strategic participation in the learning process, particularly for students who struggle with writing and reading skills.

Considering the specific challenges encountered in learning German (e.g., conjunction usage, writing appropriate to text types, sentence structure), the suggestion, example, and correction mechanisms offered by AI tools enable students to develop both cognitive and metacognitive strategies. For example, the instant analysis and explanation by AI of a grammatical error in a German sentence written by a student is not only a correction function but also provides the learner with an opportunity to learn from their own mistake.

AI tools also contribute to the applicability of learning strategies in different social forms. In individual work, AI can analyze the learner's strengths and weaknesses and suggest personalized strategies; in partner or group-based work, it can serve as a guiding and complementary learning partner in collaborative tasks.

In the context of German language learning advising, AI enables learners to manage their learning processes more consciously, develop individualized strategies, and effectively achieve their learning goals. By making strategic contributions to the advisory process, it becomes not just a technical support tool, but a pedagogically meaningful and functional element.

Method

This study is based on a three-session counseling process conducted in line with the course "Learning Advising and Coaching in Language Education II" within the scope of the German Language and Education Master's Program at Trakya University. A qualitative case study design was adopted, which provides the opportunity to explore a current phenomenon in depth and within its real-life context (Yin, 2018). Consistent with research emphasizing the relevance of individual-centered and context-embedded analyses in similar methodological frameworks (Coombs, 2022), this study examines how AI-supported tools shape the foreign language learning advising process. The advising sessions conducted with a single participant were analyzed through observation notes, client–advisor transcripts, and session-based reflections in order to obtain a multidimensional understanding of the process.

Importance of the Research

Foreign language learning counseling is a process that guides learners in developing autonomy, regulating their own learning processes, and developing strategies tailored to their individual needs. Learning strategies, in particular, serve as a guide for learners not only in the process of acquiring knowledge but also in how to learn, contributing to the conscious structuring of the learning process. The inclusion of AI tools in the counseling process can contribute to making the learning process more planned and sustainable by supporting the development of strategic learning, as well as offering learners individualized, flexible learning paths suited to their own pace. In this context, the study is important in terms of revealing the transformation of learning counseling in the digital age and the pedagogical potential offered by AI in the context of autonomy and strategic learning.

Purpose and Research Question

The purpose of this research is to examine the effects of consciously integrating AI tools into the foreign language learning counseling process from a pedagogical perspective. Within the scope of the case study, questions such as "how," "why," and "what" were used as a basis for determining the research questions (see Yin, 1984; Yıldırım & Şimşek, 2011). In this context, the main research question of the study was formulated as follows:

"What kind of effects does the pedagogical use of artificial intelligence tools in the foreign language learning counseling process produce?"

Sample

This research was conducted during the spring semester of the 2024–2025 academic year at the Department of German Language Education, Faculty of Education, Trakya University. The study sample was determined on a voluntary basis to participate in the counseling sessions conducted within the framework of the course titled "Learning Counseling and Coaching in Language Education II" offered as part of the Trakya University German Language Education Master's Program. Accordingly, a call for participation was made to students from different class levels; one student (n=1) from the sixth semester who responded positively to the call formed the sample of the study.

Data Collection

The data for this study were collected during the counseling sessions conducted as part of the course "Learning Advising and Coaching in Language Education II" within the scope of the Master's Program in German Language Education at Trakya University. The participant needed foreign language learning counseling due to specific difficulties encountered in German writing skills.

Hartmann (2021) highlights that AI-supported text generation can help overcome barriers in written expression by providing ideas and motivation, especially at the initial stages of writing. For this reason, ChatGPT was integrated into the advising process in a controlled manner to develop strategies addressing the participant's writing-related challenges. Since the participant had limited prior experience with such tools, ChatGPT—an accessible and well-known AI tool—was considered suitable for the study.

The data collection process was structured using multiple data sources, consistent with the nature of case studies that require an in-depth examination of a single case (Creswell, 2007). Observation notes from advising sessions, written and verbal evaluations obtained during and after the sessions, and transcripts of advisor–client interactions (recorded with informed consent) were used as the primary data.

The observations included the participant's interaction with the AI tool, learning motivation, and development throughout the advising process. The feedback provided during and after the sessions reflected the participant's experiences and perceptions.

Three advising sessions were conducted in total. The first session took place face-to-face, whereas the second and third were held online at two-week intervals due to the summer break. Both face-to-face and online formats are considered appropriate in foreign language advising depending on contextual needs (see Kleppin, 2004). For purposes of validity and reliability, the course instructor participated as a non-intervening observer during the sessions.

Data Analysis

The data were analyzed using descriptive analysis methods. As stated by Yıldırım & Şimşek (2011:224), descriptive analysis involves organizing data around themes, interview questions, or conceptual dimensions to present findings meaningfully.

In this study, descriptive analysis was applied to observation notes, session-based feedback, and advisor–client transcripts. Since the research was conducted as a qualitative case study with a single participant, an interpretive and descriptive approach was adopted. Learning behaviors observed during the sessions, participant feedback, and advisor observations were interpreted from a pedagogical perspective.

Implementation

This section details the application stages of the AI-supported advising process and the client's experiences. The three advising sessions conducted within the scope of the research were planned and executed based on the learning advising model developed by Karaoğlu Bircan (2020: 354).

Prior to the first session, the client was contacted via email, and the date and time of the session were determined through this method. Additionally, to get to know the participant better and to ensure that the advising process proceeds within the framework of counseling principles, tools used in learning advising were employed, including introductory questions[1] , language level self-assessment criteria[2] , learning style test[3] , learning type test[4] , level assessment test[5] , etc. (see Karaoğlu Bircan, 2020: 144-149). The information obtained about the client through counseling tools was compiled by the researchers and presented in Table 1.

Table 1.
Client Biography

Name	Niğda Özçelik
Age	23
Education	Student, Trakya University
Department	German Language Teaching Department / VI. Semester
Native Language	Turkish
Other foreign languages	English, German
Self-assessment of German language proficiency	"I think I am at the B1 level."
Level assessment test result	B1
Learning type	Communicative learning style (Kommunikativer Lerntyp)
Learning style	Reflective observation (Reflektierendes Beobachten)
Goals	"I want to improve my language skills, especially my writing skills." "I want to receive tips on effective learning strategies and time management while learning a language."

As seen in Table 1, the participant is a sixth-semester German Language Teaching student at Trakya University who has experience with Turkish (L1), English, and German. The consistency between the participant's self-assessment and the B1 level identified by the placement test indicates a developed sense of learning awareness. The communicative learning type and reflective observer learning style highlight a tendency toward social interaction and thought-oriented learning, while the participant's stated difficulties show a need for advising support in writing skills and time management.

[1]The questions designed to identify the client were prepared by the researchers.
[2]The language level self-assessment criteria developed by the Vienna Language Center were used. https://sprachenzentrum.univie.ac.at/ [Access date: May 20, 2025]
[3]A learning style test based on David Kolb's theoretical framework was used. https://www.lernwerkstatt.ch/ [Accessed on: May 20, 2025]
[4]An online learning type test was utilized. https://www.lerntypentest.com/typ/ [Access date: May 20, 2025]
[5]The online placement test prepared by the Goethe Institute was administered. https://www.goethe.de/ [Access Date: May 20, 2025]

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The advising sessions were conducted in both German and Turkish according to the participant's needs, with both languages used almost equally. The choice of language in advising may vary depending on advisor and client preferences (see Karaoğlu Bircan, 2020: 134). German parts of the interview were translated into Turkish by the authors to ensure semantic consistency. The sessions were carried out within the master's-level course *Learning Advising and Coaching in Language Education II*. For validity and reliability, the course instructor attended the sessions as a non-intervening observer and later conducted a brief evaluation meeting with the advisor; however, these evaluations are not discussed here, as they fall outside the scope of the study.

Each advising session lasted approximately 30–40 minutes and was systematically transcribed and analyzed under three components: transcript excerpts, feedback, and descriptive analysis.

Transcription: Texts created by transcribing sections deemed important for the research from the audio recordings of the counseling sessions.

Feedback: This includes the client's verbal and written feedback.

Descriptive Analysis: This includes descriptive evaluations obtained from the systematic interpretation of the transcriptions and feedback.

First Session

The first advising session began with the advisor introducing themselves and asking introductory questions (e.g., hobbies, interests) to the client in order to put them at ease and create a trusting environment. The client stated that they encountered various problems in the process of learning German. These problems can be summarized as deficiencies in speaking and writing skills, difficulties in reading comprehension, errors in the correct use of grammatical structures, and insufficient vocabulary. In particular, it was determined that the client experienced difficulties with time management due to overthinking during the writing process, and this was identified as a key focus for improving German writing skills.

In the later stages of the session, the inventories (personal identification questions, language level assessment criteria, learning style and learning type tests) that the client had previously completed via email were reviewed with the advisor.

In addition, a learning contract (Lernvertrag) was drawn up between the advisor and the client to formalize the identified goals. The contract clearly defined the areas the client would work on and their responsibilities throughout the process.

In a later stage of the session, the client was asked to create a mind map based on the issue identified as a problem, and the function of this strategy was explained. The mind map aimed to help the client systematically express their thoughts, organize their ideas, and gain awareness, particularly regarding the skills they perceived as lacking.

Finally, the advisor summarized the topics discussed and presented recommendations for the identified problem area. In this context, the advisor suggested that, in addition to various strategies for developing writing skills, the use of AI could also be beneficial in writing, and, in this regard, recommended the strategic use of the ChatGPT tool during the advising process. The advisor explained how ChatGPT could be used in the session to implement a *"Tandemgeschichte"* (tandem story) activity, a text type that plays an important role in developing writing skills. This strategy was presented as one that would enable the client to organize their thoughts during the writing process and manage their time more effectively.



Figure 1. *Client and Advisor in the First Session*

Transcription 1

Below are selected examples of client–advisor interactions from the first advising session.

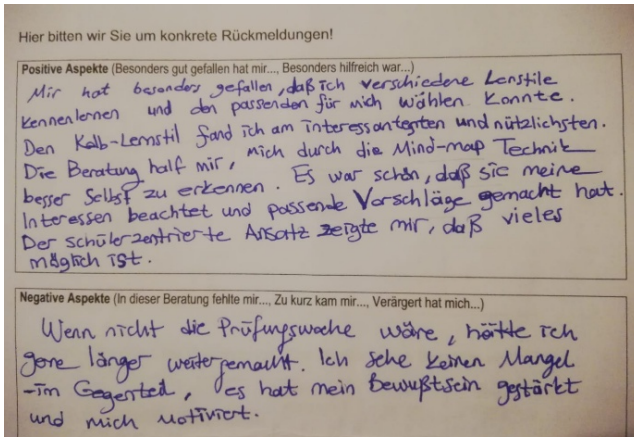
> ***Advisor:*** *[…] You have written two points here. (reads aloud) You said, "I want to receive tips on effective learning strategies and time management while learning a language." Hmm, so you mentioned time management in language learning. Could you elaborate on that a bit more?*
>
> ***Client:*** *Hmm. Well... let me put it this way. When I have homework or when I'm studying on my own, I struggle with time management. I think I've completed the assignment or task, but especially in exams, like writing exams or traditional exams, I spend more time trying to write the best answer possible. I feel like I can't manage my time well. I can't move spontaneously, you know? Like, I wonder if the word I'm using is appropriate for the B1 level or if there's another synonym... I feel like I'm wasting time while thinking. [...]*
>
> ***Advisor:*** *[…] Do you like technology? How's your relationship with AI? (smiles slightly)*
>
> ***Client:*** *I'm interested in AI , but it's not very deep. (smiles slightly) […]*
>
> ***Advisor:*** *In addition to the many strategies I've offered you to improve your spontaneous writing, I can give you another piece of advice. You just said... I see, I'm thinking about what to do, I can't write because I'm thinking too much. ... At this point, my suggestion is to create a "Tandemgeschichte." Here's how it works: you write one sentence, and the AI writes the next. You'll write a story together. You will create a reciprocal text, meaning the flow of the text will develop spontaneously. […]*

The transcript directly reflects the client's difficulties with writing skills and time management, as well as the advisor's guiding questions and suggestions. In this context, learning objectives and solution proposals were developed during the advising process.

Feedback 1

At the end of the session, some examples of the client's verbal feedback regarding the advising process are presented.

Statements such as *"I became a little more aware of myself"* and *"I found the learning style test very interesting and enjoyable"* show that even the first advising session increased the client's awareness and was engaging. In addition to verbal feedback from the client about the process, written feedback was also obtained. In this evaluation, the client expressed satisfaction with the attention paid to her areas of interest and the suitability of the recommendations made; with the statement *"The advising helped me understand myself better,"* they also indicated that the advising process reinforced her awareness of the individual learning process (see Figure 2). The consistency between the written and verbal statements during and after the advising process indicates that the process was beneficial to the client.


Hier bitten wir Sie um konkrete Rückmeldungen!

Positive Aspekte (Besonders gut gefallen hat mir..., Besonders hilfreich war...)

Mir hat besonders gefallen, daß ich verschiedene Lernstile kennenlernen und den passenden für mich wählen konnte. Den Kolb-Lernstil fand ich am Interessantesten und nützlichsten. Die Beratung half mir, mich durch die Mind-map Technik besser Selbst zu erkennen. Es war schön, daß sie meine Interessen beachtet und passende Vorschläge gemacht hat. Der schülerzentrierte Ansatz zeigte mir, daß vieles möglich ist.

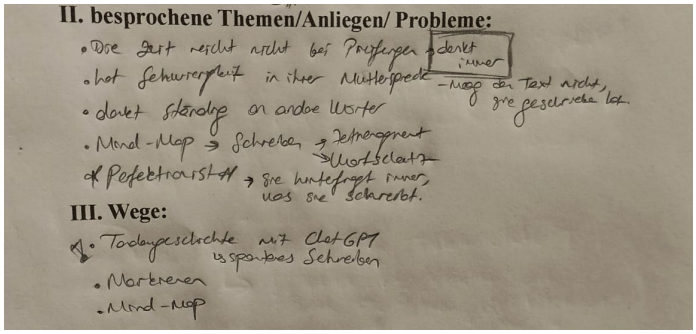
Negative Aspekte (In dieser Beratung fehlte mir..., Zu kurz kam mir..., Verärgert hat mich...)

Wenn nicht die Prüfungswoche wäre, hätte ich gerne länger weitergemacht. Ich sehe keinen Mangel. Im Gegenteil, es hat mein Bewußtsein gestärkt und mich motiviert.

Figure 2. *Client's Written Feedback Example Regarding the First Session*

Descriptive Analysis 1

The first advising session contributed to the client's awareness of their strengths and weaknesses in the learning process, clarifying her learning goals, and developing strategic solutions. The client's lack of confidence in the German texts they wrote inside and outside of class and her constant self-questioning indicate a perfectionist tendency. The advisor's notes also indicate that this situation has a negative effect on writing productivity (see Figure 3).


II. besprochene Themen/Anliegen/ Probleme:

- Dse fast nescht nicht bei Prüfungen denkt immer
- hat Schwierigkeit in ihrer Muttersprache - Mapp den Text nicht, wie gesschrieben hat.
- denkt ständig an andre Wörter
- Mind-Map → Schreiben → Zeitmanagment → Wortschatz
- Perfektionistin → sie hinterfragt immer, was sie schreibt.

III. Wege:

- Tandemgeschichte mit ChatGPT → spontanes Schreiben
- Markieren
- Mind-Map

Figure 3. *Example of Advisor Notes for the First Session*

In light of these findings, integrating the *"Tandemgeschichte"* activity, a type of fictional text creation that encourages spontaneous writing and aims to accelerate the thinking process, with the ChatGPT was considered a functional approach for the client (see Transcript 1). The client's communicative learning style was decisive in recommending this activity. The client's tendency to learn through interaction suggests that the process of creating a joint product with AI can both support motivation and increase fluency in the writing process.

Therefore, the first session established a foundation and awareness of the learning process, where the client's needs were systematically analyzed and individualized strategic recommendations were developed accordingly (see Feedback 1). Client feedback and advisor notes indicate that the proposed approach could contribute to the development of the client's writing skills.

Second Session

The second session began with a brief introductory conversation about the client's general situation, followed by a focus on whether the strategies recommended in the previous session had been implemented. The client stated that they tried the *"Tandemgeschichte"* activity with ChatGPT (see Figure 4). She mentioned that she had used different AI tools before, but had not found this tool to be so functional in the language learning process.

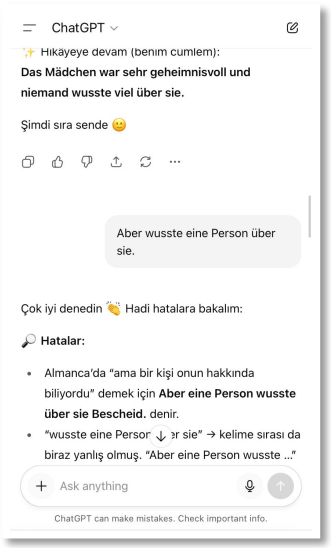


Figure 4. *Example of the Client's "Tandemgeschichte" Application Using the AI Tool ChatGPT*

During the session, the client shared their positive and negative experiences with the application in question. She emphasized that the strategy accelerated the writing process and that analyzing the errors in the texts generated by ChatGPT was quite useful for her. However, she mentioned that she sometimes struggled due to a lack of connected vocabulary knowledge in the process of creating fluent text (see Figure 5).

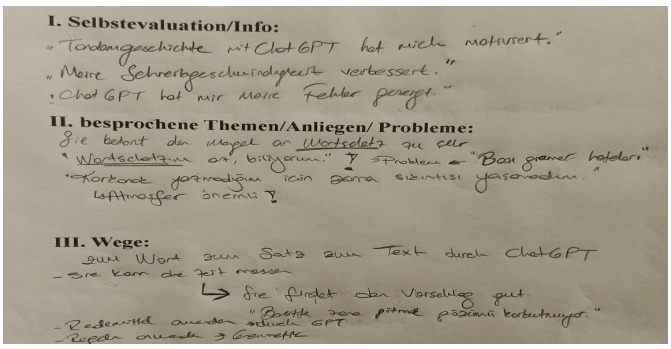


Figure 5. *Example of Advisor Notes for the Second Session*

Based on these findings, it was recommended that the client apply the *"vom Wort zum Satz zum Text"* (from word to sentence to text) strategy using the ChatGPT. The advisor explained in detail how to apply the strategy. This strategy can also be applied without AI support; however, in this case, the learner must be provided with keywords appropriate to the specified level and topic. The use of AI can both provide these words and offer immediate feedback to the learner by analyzing errors in the generated text.

The client indicated that could implement this application, and the session was concluded with a summary of what was discussed and the client's verbal evulations.

Transcription 2

This section contains the dialogues between the advisor and the client, and the meeting focused particularly on the implementation of the strategies suggested in the previous session and the sharing of experiences related to them.

> ***Advisor:*** *Were you able to apply what we discussed in the last session? For example… "Tandemgeschichte"?*
>
> ***Client:*** *Yeah, I did.*
>
> ***Advisor:*** *How was your experience? I'm curious about that.*

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Client: *Being able to see my own mistakes made me feel good about myself. I see my mistakes at the same time and noticed that my learning process has accelerated. So (thinks) I tried to produce something with the information I had. I said, "This was wrong." I also tried to show my previous mistakes in my other sentences by not making them.*

Advisor*: […] Did you look at your own sentences in the text you wrote? What do you think you did well and what did you do poorly?*

Client: *Well, I know my vocabulary is limited, I have a good grasp of grammar, but I made some grammatical mistakes. I had plenty of opportunity to observe my own mistakes... I noticed that I felt more comfortable writing to AI. […]*

Advisor: *[…] You can ask ChatGPT for five keywords on a theme that will encourage you to write and then write a text using them in sentences. You can time yourself while doing this. Words can turn into sentences, and sentences can turn into text. So, what do you think? Will it be challenging, or will you get bored while doing it?*

Client: *No, not at all. As you said, moving from simple to complex, from parts to the whole, doesn't intimidate me. I can do it. […]*

As seen in the transcript, the client found the AI-assisted writing experience positive, noted progress in recognizing and correcting mistakes, and expressed willingness to try the newly suggested strategies.

Feedback 2

In client's verbal feedback, the client used the phrase *"I saw that I could do things with ChatGPT*," emphasizing that the digital tool made a concrete contribution to their production process. In this context, she stated that AI-supported applications make the learning process more effective when used continuously. In her written feedback, as mentioned in the advising session, she stated that the opportunity to recognize her own mistakes is critically important for learning (see Figure 6).

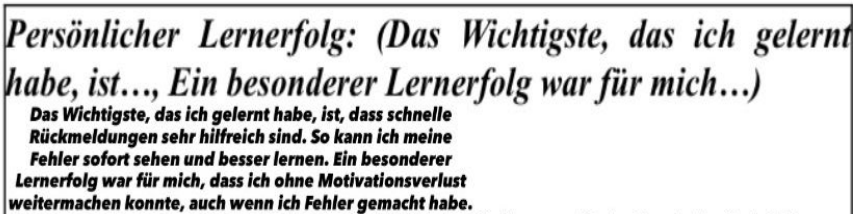


Figure 6. *Example of the Client's Written Feedback for the Second Session*

Furthermore, the client defines being able to continue writing without losing motivation as a personal success. This shows that the client has developed autonomy in the writing process and that error awareness has a supportive function for internal motivation towards learning.

Descriptive Analysis 2

The second learning advising session played an important role in developing the client's awareness of the writing process. The analysis of the transcript and feedback shows that the client realized that made the writing process more efficient through AI-supported strategies. In particular, her ability to recognize her mistakes instantly and reduce these mistakes in subsequent productions indicates that the client has made progress in her writing skills.

The themes of autonomy, motivation, and error awareness stand out in both the client's verbal and written feedback (see Feedback 2). The learner's statement that they felt more comfortable working with AI suggests that digital tools can serve as psychological support in the learning environment. This situation is understood to contribute to a reduction in anxiety during the writing process and the formation of a more consistent writing practice.

However, the client mentioned her limited vocabulary as an obstacle. It was stated that this deficiency could be overcome with the *"vom Wort zum Satz zum Text"* strategy suggested by the advisor, and the

client's positive approach to this strategy shows that guidance based on the principle of progressing from simple to complex contributes to learner motivation (see Transcript 2).

In conclusion, the findings from the second session reveal that AI-supported strategies support the client's writing process, develop error awareness, and encourage learner autonomy. Furthermore, the client's positive attitude towards new strategies holds significant potential in terms of continuity and sustainable learning in the advising process.

Third Session

The third session was planned as an evaluation session. The main purpose of this session was for the client to share all her experiences gained during the advising process and evaluate them in detail with the advisor.

In this context, the AI tool and writing strategies recommended for implementation in the previous two sessions were reviewed in detail during this session.

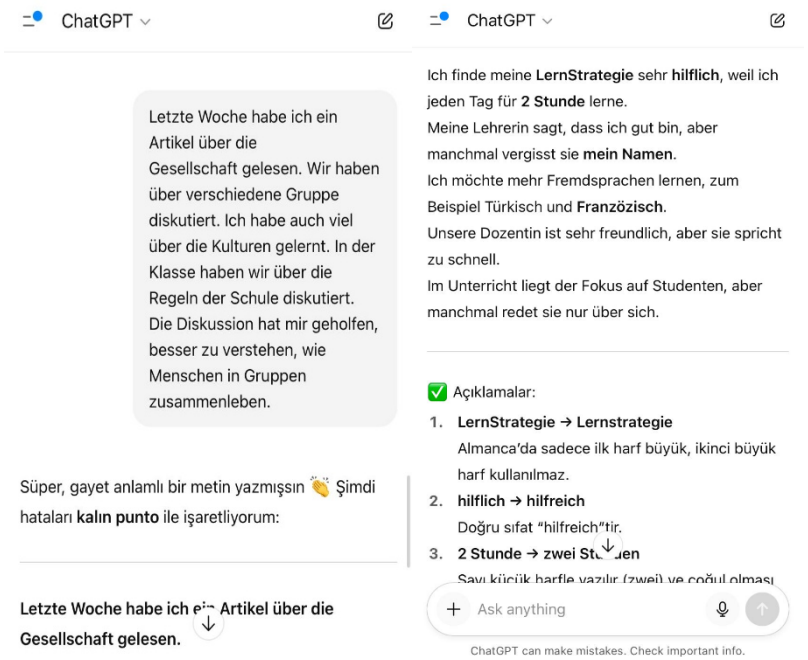


Figure 7. *Example of the Client's Application "Vom Wort zum Satz zum Text" Using the AI Tool ChatGPT*

In the later stages of the session, evaluation questions were asked to understand how the use of AI made the client feel. Thus, the focus was not only on the application process but also on the client's emotional experiences. The client shared her experiences throughout the process and her evulations of her own performance. At this point, both her observations regarding the writing process and her views on the effects of working with AI on motivation, error awareness, and the learning process were recorded.

Overall, the third session served an important function in terms of reinforcing the client's previous gains, deepening strategies, and evaluating the process from a holistic perspective.

Transcription 3

The third session addressed how the client applied the strategies suggested in previous sessions through AI and how these experiences reflected on the writing process and motivation. Representative transcripts of relevant conversations are provided in this context.

> ***Advisor:*** *In the previous session, we discussed writing strategies such as vom Wort zum Satz zum Text. If you applied this strategy with ChatGPT, could you share your experiences?*
>
> ***Client:*** *I liked receiving quick feedback because it allowed me to see my mistakes immediately. However, noticing these mistakes sometimes discouraged me. […]*

Advisor: *[…] So you noticed your mistakes, but where exactly do you think you're making mistakes while writing?*

Client*: I focus too much on grammar. This slows me down and sometimes even causes additional mistakes. So that's why... So when I write faster, the first thing that comes to mind is correct. I've observed this. That's why I've noticed that when I think too much, I make more mistakes. It really is true that the first things that come to mind are correct. I've had the opportunity to observe this. That's why I think it's good in terms of time management. Now I've started writing whatever first comes to mind. And this has actually started to motivate me [...]*

Advisor: *[…] You've experienced the "Tandemgeschichte" and "vom Wort zum Satz zum Text" strategies with AI, and at the same time, you've noticed your mistakes and received feedback. Do you plan to use these strategies in the future?*

Client: *I want to continue experimenting whenever I have time. In fact, I want to learn different languages. Of course, my priority is German, but I said I could try other languages too. I said to myself, why not? I can transfer these applications there too [...]*

This transcription reflects the client's thoughts on error awareness, time management, and motivation during the process of applying AI-supported writing strategies.

Feedback 3

The client found the strategies new. At the end of the process, she stated that they realized the importance of continuous practice in the language learning process, that she was able to plan her time more efficiently, and that she considered the entire advising process a valuable experience for herselves. The client stated that she wanted to use the gains she had made in the future both in learning German and in learning other languages, and that thanks to the learning advising process, she had discovered how to learn more effectively and could share the experiences she had gained in this process with others who wanted to learn foreign languages (see Figure 8).

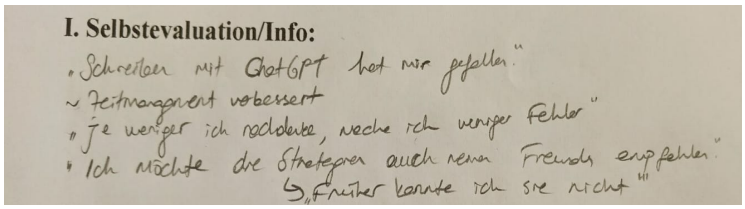
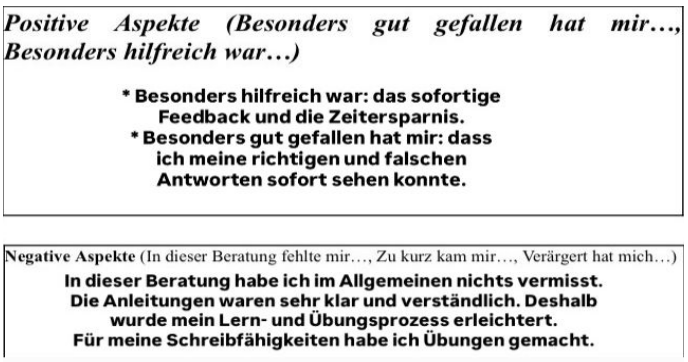

I. Selbstevaluation/Info:
- „Schreiben mit ChatGPT hat mir gefallen."
- Zeitmanagment verbessert
- „Je weniger ich nachdenke, mache ich weniger Fehler"
- Ich möchte die Strategien auch meinen Freunds empfehlen.
  ↳„Früher konnte ich sie nicht"

Figure 8. *Example of Advisor Notes for the Third Session*

The client emphasized that she found AI particularly functional in the context of writing strategies, evaluating ChatGPT's ability to show correct and incorrect answers simultaneously, provide feedback through error analysis, and ensure time efficiency as its strengths (see Figure 9).


Positive Aspekte (Besonders gut gefallen hat mir…, Besonders hilfreich war…)

*** Besonders hilfreich war: das sofortige Feedback und die Zeitersparnis.**
*** Besonders gut gefallen hat mir: dass ich meine richtigen und falschen Antworten sofort sehen konnte.**

Negative Aspekte (In dieser Beratung fehlte mir…, Zu kurz kam mir…, Verärgert hat mich…)

In dieser Beratung habe ich im Allgemeinen nichts vermisst.
Die Anleitungen waren sehr klar und verständlich. Deshalb wurde mein Lern- und Übungsprozess erleichtert.
Für meine Schreibfähigkeiten habe ich Übungen gemacht.

Figure 9. *Example of the Client's Written Feedback for the Third Session*

The client stated that she did not have much experience with AI tools prior to advising, but with the advisor's guidance, she was able to use these tools more confidently and effectively. She concluded that

this experience contributed meaningfully to the German learning process and stated that she believed unsupervised AI use could evolve into a more autonomous form of learning over time.

Descriptive Analysis 3

The findings of the third session reveal that both the client's strategic awareness and level of autonomy developed during the language learning process. The client appears to have made significant gains, particularly in the context of metacognitive strategies. Her observations on time management, error awareness, and planning skills during the writing process show that the client was able to organize her own learning process and make conscious choices. This proves that metacognitive awareness has increased and self-regulation skills have developed in the learning process.

Furthermore, the client's experiences are also noteworthy in terms of cognitive strategies. Her tendency to write faster while applying writing strategies such as *"Vom Wort zum Satz zum Text"* (from word to sentence to text) and *"Tandemgeschichte"* (tandem story) demonstrates that she effectively uses cognitive processes such as repetition, trial and error, and direct application in language production. By analyzing the feedback received from the ChatGPT, correcting their mistakes, and modeling correct examples, it is revealed that the cognitive dimension of learning is reinforced with the support of technology.

In addition, a strong affective dimension was observed in the client's statements. Despite noticing her mistakes, maintaining her motivation and evaluating the writing process as a more enjoyable and encouraging experience indicates the effectiveness of affective strategies (see Transcript 3).

Finally, it is understood that the client effectively applied AI-supported writing strategies during the advising process and can transfer the awareness gained from this experience to future autonomous learning (see Transcript 3, Feedback 3). This finding demonstrates that the client has gained awareness in the context of the principle of sustainable learning.

Conclusion and Suggestions

This study has revealed the effects of the pedagogically appropriate and conscious integration of AI tools into the foreign language learning advising process on the learner. The three-session advising process shows that AI-supported approaches can be evaluated not only as a technical tool but also as a pedagogical component that supports strategic, affective, and cognitive learning processes.

The research findings show that the strategic use of AI tools in the advising process led to significant improvements in the learner's autonomy, error awareness, time management, and motivation. The client's interaction with ChatGPT was functional in terms of analyzing errors, developing time management skills, and achieving more fluent production in the writing process. The integration of the *"Vom Wort zum Satz zum Text"* (from word to sentence to text) and *"Tandemgeschichte"* (tandem story) strategies with AI strengthened the client's cognitive and metacognitive strategies.

The results obtained show that the interaction process with AI is not only a technical but also an emotional learning experience for the client. The client maintained their motivation despite recognizing their mistakes; this is directly related to the trust environment created during the counseling process and the AI's instant feedback mechanism. These findings suggest that incorporating AI tools into counseling processes can add an innovative and personalized dimension that enriches traditional models. Furthermore, the client stated that the strategies applied with ChatGPT during the advising process could be used not only in German but also in other foreign languages they wish to learn. This indicates that AI-supported advising can have lasting effects in terms of learning awareness and strategic transfer.

The counseling process also revealed that AI tools yield more meaningful and reliable results when used under pedagogical supervision and guidance. The client initially viewed AI not as an independent teaching tool but as a complementary learning element used alongside counselor guidance; however, after gaining experience, they emphasized that it could also be used more autonomously.

These findings indicate that the integration of AI tools into language learning counseling requires careful pedagogical planning, strategic guidance, and emotional support. Therefore, the recommendations

presented below have been developed based on observations made during the research process and with the aim of ensuring the sustainable use of AI in a counseling context.

Suggestions

1. Pedagogical Framework: AI tools should be used in language learning counseling in a manner consistent with pedagogical goals. Therefore, it is important to strengthen the pedagogical training and digital literacy of counselors or educators regarding AI-supported applications.
2. Advisor and Educator AI Collaboration: AI tools should be seen as a complementary element that supports the counseling and learning process. Learners' feedback should be interpreted under the guidance of counselors and educators and integrated into strategic learning plans.
3. Strategy Training with AI Integration: AI is more effective when integrated with strategy training, especially in production-oriented skills such as writing. Therefore, AI-supported strategy training applications should be given more space in counseling and learning processes.
4. Future Research: This study is limited to a single participant. More comprehensive research conducted in the future with different language levels and skill areas may provide more in-depth data on the generalizability of AI-supported tutoring.

In conclusion, this study has demonstrated that AI tools, when used in a pedagogically guided manner in foreign language learning counseling processes, are an effective support element that enhances learner autonomy, increases motivation, and contributes to the development of writing skills. In this context, AI-supported counseling can be considered an innovative, customizable, and sustainable model that responds to the learning needs of the digital age.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Conflict of Interest: The authors declare that there is no conflict of interest.

Generative Artificial Intelligence Statement: Generative artificial intelligence (AI) was used in this study, particularly for translating citations and for language editing to check the accuracy of the translations.

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Managing Classroom Discipline In Digital Society

Rozalina Popova-Koskarova[1]

Abstract

The paper deals with a very important issue in the daily work of the teacher, namely disciplinary problems and their successful management. Disciplinary problems are always a great challenge for the teachers. In today's digital society, managing disciplinary problems requires a different approach than traditional methods. How discipline problems will be managed , depends on many factors. However, it mostly depends on the skill of the teacher to successfully deal with all the challenges brought by the new era.The subject of research is managing disciplinary problems in the class, and the purpose of the research is to examine how teachers deal with in this digital society. For realizing purpose and tasks of the research, we used a survey sheet with closed-ended questions, on a sample of 139 primary education teachers from the entire country (R.N.Macedonia).The survey showed that teachers need greater support for managinig classroom discipline in appropriate way. The study highlights the need for professional training focused on emotional intelligence, conflict resolution, and the use of democratic strategies that foster a positive socio-emotional classroom climate. Therefore, teachers must develop digital pedagogical literacy and use modern tools for prevention and intervention when inappropriate behavior occurs.

Keywords: classroom discipline, teacher, management, digital society

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Introduction

In today's digital society, managing disciplinary problems requires a different approach than traditional methods. Students live in a world of constant connectivity, instant information, and social media, which strongly influences their concentration, behavior, and communication. Therefore, teachers must develop digital pedagogical literacy and use modern tools for prevention and intervention when inappropriate behavior occurs.Contemporary teachers strive for a partnership-based relationship with students, where discipline is built through empathy, dialogue, and digital ethics, rather than fear and punishment. Techniques such as positive discipline, restitution, mediation, and collaborative learning have proven to be much more effective than traditional punitive measures.

Additionally, digital technologies can serve as support tools rather than sources of problems—through platforms for communication, progress tracking, and encouraging students' self-regulation. It is essential for schools to foster a culture of responsible digital use, where students understand that discipline is an integral part of both personal and online behavior.

This paper focuses on their characteristics and the ways in which they shape approaches to managing disciplinary problems. Considering the importance of this pedagogical issue, the research team—led by the author—was motivated to examine essential aspects of effective classroom management and teacher-student relations.

Literature Review

Past experiences reveal that there are various ways of addressing disciplinary problems, which largely depend on the leadership style—namely, the educational style practiced by the teacher. Pedagogical literature generally distinguishes three types of leadership styles: authoritarian, democratic, and laissez-faire (anarchic). Each of these styles exerts a distinct influence on the socio-emotional climate within the classroom.

The authoritarian teacher shows little sensitivity toward students' needs and tends to address disciplinary problems through punishment, threats, and accusations. Such behavior suppresses students' individuality and independence. According to Gašić-Pavišić (2005), this approach limits the teacher's role to the transmission of knowledge, neglecting the moral, emotional, and social dimensions of child development.

Common characteristics of this style include intimidation, criticism, and a lack of respect toward students. Although corporal punishment has long been prohibited, some teachers continue to use psychological punishments—such as humiliation and verbal insults—that leave long-lasting emotional scars.

The authoritarian climate fosters fear and tension instead of comfort and security, often leading to further behavioral problems. Teachers with this orientation typically respond to disciplinary incidents with rigid measures, such as lowering grades, removing students from class, or referring them to the school counselor—without addressing the root causes of the behavior.

According Popova-Koskarova (2008) subtypes of this style include the punitive teacher and the accusatory teacher, recognizable by statements such as "You'll never amount to anything," "You're always last," or "You can't do anything right" (Popova-Koskarova, p. 31).

In contrast, the democratic teacher encourages a constructive and participatory classroom environment. This teacher resolves conflicts through dialogue and shared responsibility, cultivating a positive socio-emotional atmosphere. Subtypes include the friendly teacher, the observer, and the facilitator, the last of which is considered the most effective.

Such teachers often use affirming statements like, "It's okay to make mistakes, but find a way to correct them," reinforcing self-reflection and accountability rather than fear.

One of the most effective techniques used by democratic teachers is restitution, a method described by Gossen (2004) and Penner (2011) as an approach that replaces punishment with opportunities for students to correct mistakes, repair relationships, and learn genuine responsibility. Restitution builds self-awareness and self-control while maintaining respect and dignity.

Method

Subject Purpose and Tasks

The research examines how teachers handle and manage disciplinary problems within the classroom context.The main purpose is to analyze teachers' approaches to solving disciplinary problems and their awareness of modern pedagogical techniques. The study aimed to:

- Examine teachers' attitudes toward handling disciplinary problems;
- Determine their familiarity with modern educational strategies such as restitution;
- Explore their opinions on the use of corporal and psychological punishment;
- Assess their views on the causes of disciplinary problems; and
- Identify teachers' perceived needs for professional training.

The research employed a survey method using a structured questionnaire distributed online via Google Forms. The sample consisted of over 100 primary school teachers from different regions of North Macedonia.

Findings

1.Question: Frequency of Disciplinary Problems

Nearly half of the teachers (48.1%) reported that disciplinary problems occur occasionally, while 38.5% said they occur rarely. Only 11.5% indicated that problems happen very often, and 2% reported no such problems. These findings suggest that disciplinary issues in Macedonian schools are not highly prevalent but still warrant systematic attention.

2.Question :Initial Teacher Responses to Problems

When asked what measures teachers first take when they cannot handle disciplinary issues in class, five main options were offered:

- **60%** of teachers reported that they first **talk privately with the student**;
- **30%** contact **parents**;
- **7.7%** seek help from **school support staff**;
- **2%** reduce grades or conduct marks;
- **1%** remove the student from class.

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These results indicate that most teachers adopt a **constructive, dialogue-based approach** to discipline. In the context of today's **digital society**, this trend becomes even more significant.

Teachers who choose to engage in private conversations with students demonstrate sensitivity to the need for **personalized and confidential communication**, which is crucial in both in-person and virtual settings. Moreover, digital tools can serve as valuable support mechanisms—facilitating teacher-student dialogue, monitoring behavior, and strengthening cooperation with parents and school counselors.

Ultimately, school discipline in the digital era should aim to **foster digital responsibility, empathy, and self-regulation** among students. This approach helps learners recognize that appropriate behavior extends beyond the classroom walls into their online interactions, forming a foundation for respectful participation in both real and virtual communities.

3.Question: Teachers' Attitudes Toward Corporal Punishment

Almost **70%** of respondents stated they **disapprove** of corporal punishment. However, around **22%** still believe it may help in certain situations, showing that traditional attitudes persist to some degree.In

the context of the **digital era**, where students are more aware of their rights, autonomy, and emotional well-being, corporal punishment is not only inappropriate but also counterproductive. Modern approaches emphasize **positive discipline, dialogue, and restorative practices** that promote respect, empathy, and responsibility rather than fear and obedience

4.Question: Teachers' Perceptions of Causes

From Identifying reasons for disciplinary problems, teachers most frequently cited:

- Insufficient attention to students' personal needs (38.6%);
- Schools not adapted to modern digital-age learners (24.8%);
- Teacher workload and administrative burden (20%);
- Monotonous and non-interactive lessons (16.8%).

These findings suggest that disciplinary problems often stem from **systemic and pedagogical factors**, rather than simply from student misbehavior. The fact that nearly one-quarter of teachers believe schools are not adapted to digital-age learners highlights the urgent need for **innovation in teaching methods** and **modernization of school environments**. In an era where students are constantly exposed to technology, interactivity, and instant access to information, traditional classroom structures may feel restrictive, resulting in disengagement or disruptive behavior.

5.Question: Awareness of Modern Techniques

When asked about **restitution**, 42% of teachers stated they were familiar with it, 32% said they were **not**, and 26.2% had **heard of it but forgotten its application**. This suggests a need for targeted professional development in restorative classroom manage with technique that allows students to correct mistakes without humiliation, anger, or resentment. Therefore, continuous professional development and **teacher training focused on non-punitive conflict resolution** are essential to fully eliminate residual authoritarian practices and align discipline with the principles of democratic and inclusive education.

Discussion, Conclusion, and Suggestions

Disciplinary problems are always a great challenge for the teachers. In today's digital society, managing disciplinary problems requires a different approach than traditional methods. How discipline problems will be managed , depends on many factors. However, it mostly depends on the skill of the teacher to successfully deal with all the challenges brought by the new era.Based on the results, it can be concluded that: Students are increasingly influenced by online interactions, social networks, and digital communication patterns that shape their attitudes, attention spans, and emotional responses. Consequently, disciplinary issues often emerge not only in the physical classroom but also in the digital learning environment—through behaviors such as distraction by devices, lack of focus, or inappropriate online conduct. In other words, we `ve been concluded that:

1. Most teachers demonstrate constructive attitudes toward managing disciplinary problems.
2. The vast majority (98%) reject corporal punishment as an acceptable educational tool.
3. Teachers are aware that insufficient communication and monotony in teaching can contribute to student misbehavior.
4. Many teachers lack sufficient training in modern pedagogical techniques, particularly restitution and other restorative approaches.

Our suggestions:Ultimately, school discipline in the digital era should aim to foster digital responsibility, empathy, and self-regulation among students. This approach helps learners recognize that appropriate behavior extends beyond the classroom walls into their online interactions, forming a foundation for respectful participation in both real and virtual communities.

- Organize teacher training programs focused on conflict resolution, emotional intelligence, and restorative practices.
- Introduce interactive and student-centered teaching methods to increase engagement and reduce discipline issues.
- Foster collaboration between teachers, parents, and school support staff to address students' personal and emotional needs.
- Promote a democratic classroom climate that emphasizes dialogue, empathy, and shared responsibility.

Acknowledgment

Ethics statement: In this study I declare that the rules stated in the ''Higher Education Institutions Scientific Research and Publication Ethics Directive'' are complied with and that I do not take any of the actions based on ''Actions Against Scientific Research and Public Ethicc ''. At the same time, I declare that there is no conflict of interest and all responsibility belongs to the author in case of all ethical violations.

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Movement as a Learning Tool in Teaching Music in Primary Schools

Nataša Vukićević[1]

Abstract

The connection between music and movement is primarily determined by the temporal nature of both phenomena. Movement is at the core of music itself, but also of numerous musical syntagms which can define and provide the interpretation of tools for musical expression (musical flow, melodic motion, rhythmic movement, interval movement). Musical activities are inseparable from movement in all aspects - performance, creation and perception of music. The above facts unambiguously and logically imply the use of movement in the process of music education in primary schools. The positive effects and benefits of applying an approach that combines music and movement are particularly pronounced in the initial stages of learning, at preschool and early school age.

The aim of this paper is to point out the possibility of using movement as a didactic tool in teaching music in the third and fourth grades of primary schools. The research tasks are focused on two aspects: 1) the role of movement in the process of acquiring musical concepts through the field of music performance and 2) the application of movement in the process of perceiving musical elements in the field of listening to music. Based on previous research, the primary importance of movement is emphasized in the preparatory phase of introducing concepts in the field of rhythm, in the phase of determining and distinguishing pitches, in testing students' knowledge, and in the field of listening to music for the purpose of developing the ability of analytical listening and perception of musical phenomena. This paper presents specific examples of the application of movement in the process of learning music in accordance with the current curriculum content in Serbia. The above-mentioned examples indicate that methodological approaches coincide with the elements of well-known methods of Carl Orff, Zoltan Kodály, and Émile Jacques-Dalcroze, although these methods are not officially applied in Serbia. The presence of movement-based elements in various approaches to the acquisition of musical concepts confirms the natural connection between music and movement and the importance of their integration in music education. Therefore, we conclude that movement as a didactic tool can be applied in teaching young learners in a broader socio-educational space, with minimal adaptation to the individual curriculum guidelines of different countries.

Keywords: Movement, acquisition of musical concepts, teaching music, young learners.

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Introduction

Movement, according to numerous definitions and findings (Bojanin, 2006, as cited in Lazić, Matović & Velišek-Braško, 2019), is the most suitable means of expression and learning for young children and the basis of their overall development. In accordance with their natural need for movement and activity, children acquire their first understandings of the world around them through various physical activities, by observing and imitating people, phenomena and objects in their environment, forming relationships with them and perceiving themselves within those relationships. Movement enables them to develop and improve "their motor skills and abilities, as well as the cognitive and socio-emotional aspects of development" (Lazić, Matović, & Velišek-Braško 2019, p. 28). The child's development occurs simultaneously across different domains, among which music, and music education, holds an important place. In the field of preschool music education, movement takes on an educational role because it supports the experience and perception of musical structure elements, which at an early age cannot be understood without the mediation of visual stimuli (Petrović, 2015). According to the author Milena Petrović (2015), "preschool children react most naturally to musical content when it is presented to them simultaneously through the integration of listening, singing, playing instruments, movement (dancing), and notation" (Petrović, 2015, p. 123), in the form of various pictorial materials or graphic symbols. In a similar way, children in the first grades of primary school acquire musical content by relying on extra-musical elements such as movement, images and stories. "Incorporating movement in music is natural, effective and important, especially during early education" (Rhett, 2020, p. 14), but it seems that in practice this aspect of teaching is lacking.

Although movement, based on the stated advantages and its ability to influence the development of students in all aspects, has an irreplaceable role in early music education, it can also be successfully applied in the implementation of content in the third and fourth grades of primary school (ages 9–11). Considering that the focus of music education during this period is on acquiring musical concepts and developing students' music literacy, movement represents an important component of the methodological approach that will facilitate students' learning and discovery process. We emphasize that the content, approaches and requirements discussed in this paper are within the framework of the current Teaching and Learning Program in Serbia. It is important to note that, regardless of these frameworks, the importance of music education is recognized in the curricula of most European countries whose educational documents are available to us. Although the educational systems of European countries differ, music appears as a compulsory subject in almost all curricula and includes activities of performing, creating and listening to music, which are mostly defined as separate areas and under different names (Svalina & Mucić, 2022, p. 55). The role of movement in music education has also been acknowledged as an important topic and subject of research by authors from various countries (Abril, 2011 (Miami, Florida, USA); Barrio & Arus, 2024 (Spain);); Ginman, Anttila, Juntunen, & Tiippana, 2022 (Finland); Jirickova & Van der Sandt, 2025 (Czech Republic); Pacheco-Costa, Roa-Trejo, & Guzmán-Simón, 2025 (Spain)), which proves its universality as a didactic tool in the learning process. A shared paradigm among these studies is the focus on the Kodály, Orff, and Dalcroze methods, which, even after a century, continue to provide the framework for new research and interpretations. Authors Ozgur (2009) and Prodanov, Crnjanski and Milojković (2021) go a step further and recommend returning to these methods and applying them in contemporary teaching. A certain analogy between the elements of the mentioned methods and methodological approaches to acquiring musical concepts also exists in the context of music education in Serbia.

Music possesses recognizable and widely known characteristics in terms of its expressive means and the emotional and cognitive aspects of its influence on different categories of recipients. Therefore, we believe that the conclusions and implications of this theoretical research can be applied with younger school–age students in a broader educational context, with minimal adjustments in relation to the specific guidelines of curricula in different countries.

Based on the stated foundations, we defined two research questions: 1) In what way can movement, as a didactic tool, be applied in the process of acquiring musical concepts through the domain of music performance; 2) Is the use of movement in the field of listening to music effective in perceiving musical elements?

Method

In accordance with the qualitative nature of this study, the method of theoretical analysis has been applied. The subject of the research is the use of movement in the learning process within music education in the third and fourth grades of primary school. The aim of the research is to examine the possibilities of applying movement through various methodological aspects of implementing the curriculum content of music education in the areas of Music performance and Listening to music in the third and fourth grades of primary school.

The research results are interpreted according to the established research questions in separate subsections, following an analysis of the presence of movement in the curriculum content of the Teaching music for the stated age group.

Research Results with Discussion

Representation of movement in the Teaching music curriculum

When analyzing the curriculum content for the Teaching music in the third grade, movement is used in teaching within the domain of music performance, specifically through singing songs with movement and performing various types of musical games—songs with movement, didactic games and musical dramatizations. Based on the expected learning outcomes, such as the expectation that, after completing a given topic or area in the third grade, the student recites counting rhymes in rhythm with movement and communicates with others through the performance of traditional and musical games involving movement, it can be observed that the role of movement is reduced to its function within the game itself and its musical and kinesthetic requirements/components.

At the same time, within the context of contemporary education, emphasis is placed on experience, spontaneity, communication, integrative learning and creativity—elements that can be most directly achieved and developed through the performance of musical games, among other activities. Authors define the role of play in the learning process in different ways. According to Karan (2006), play is "the most natural state of mind for children, giving them the basic meaning and stimulus for learning at this age" (Karan, 2006, p. 98). A group of Polish and Slovak authors believe that movement serves as a means of communication for children, which makes music and movement suitable focal points of musical activities and learning in the classroom (Kołodziejski, Králová & Hudáková, 2014). Petrović (2015) also emphasizes the importance of movement in the learning process, especially for understanding the relationship between tempo and character, distinguishing between strong and weak beats, recognizing an anacrusis, identifying the beginning of a phrase and noticing formal patterns. Considering that "movement usually implies play as an accompanying activity" (Petrović, 2015, p. 121), the author believes that musical game enables the unification of different areas and supports an integrated approach to learning.

In the fourth grade, students are expected to perform didactic games and, within the domain of musical creativity, to create movements to accompany the music they perform. This form of creativity involves combining the creative domain with music performance. The integration of movement and singing should be meaningful, with movement serving as support for learning the song. The recommendations for achieving goals and outcomes emphasize intra-subject connections among musical content and activities, as well as implementing teaching that incorporates listening, voice, movement and musical instruments *(Regulation on the Teaching and Learning Program (11),* 2019). In this segment of the Program, a clear tendency toward integrative learning can be observed—not only in the sense of using music to enhance "learning concepts in other areas", but also in the merging of several different forms of musical expression (Petrović 2015, p. 121).

Moreover, moving to music is appealing to children, and "its integration into the educational process can motivate students to learn, make learning enjoyable and facilitate the learning process" (Kołodziejski et al., 2014, p. 660). This fact is highly significant for music education in primary schools, which—due to the various domains and categories implemented throughout the school year—is complex and interdisciplinary (Petrović, 2015). Teaching Music has a number of specific features compared to other school subjects, while at the same time being connected to them, which is why students should be taught in a special way that makes the learning and discovery process easier for them.

Incorporating movement into the learning process is only one of the methods that can be applied with the aim of improving the quality of learning.

The aforementioned developmental characteristics of learning and knowledge acquisition in music education arise from the specific relationship between the sensory and cognitive aspects of this learning process (Petrović & Vukićević, 2015). "Music literacy and the understanding of concepts presuppose a constant two-way process between direct auditory–perceptual and cognitive–experiential understanding of music" (Petrović & Vukićević, 2015, p. 61). The methodological approach to acquiring concepts such as pitch, rhythmic values or time signature always proceeds from sensory perception toward the musical score (Vasiljević, 2006). What is equally significant in the learning process or introduction of new concepts is the preparatory phase, in which students gain musical experience through direct auditory and emotional engagement, achieved and intensified by singing songs by ear or performing rhymes—often complemented by the use of movement. However, even in this phase, students engage in mental activity, as they are tasked, for example, with distinguishing the properties of sound and tone, accurately performing the rhythm of a rhyme with movement, correctly intoning a melody, recognizing the character of a march based on its accented rhythm and 2/4 measure, and relying on the sensation of the first step when marching.

These tasks in the preparatory phase form an important foundation for the conscious perception, reproduction and understanding of given musical elements—that is, for the development of music literacy in third-grade and fourth-grade students.

Movement as a didactic tool in the field of Music performance

In the official Teaching and learning program for the teaching music in the third and fourth grades, music literacy is not presented as a separate teaching area but rather as an integral part of the domain Music performance. Additionally, music literacy is viewed within a broader context and goes beyond music theory learning (*Regulation on the Teaching and Learning program, 15,* 2019). Learning about music follows the musical development of the child, which is connected to stages of intellectual development. Accordingly, "the development of musical concepts occurs concurrently with the development of concepts in general" (Grujić Garić, 2017, p. 87), and is conditioned by students' age and their perceptual experiences. Gordon (1997, as cited in Bačlija Sušić, 2016), for example, in accordance with the pre-operational phase of children's cognitive development, prioritizes auditory musical development over symbolic development and the learning of music theory (Bačlija Sušić, 2016). Numerous other music educators support this view, believing that the experiential aspects of music education are most important in primary schools and that elementary music literacy should remain in the function of mastering other musical skills (Rojko, 2012). In contemporary music teaching, according to current program requirements, the cognitive and experiential components are in constant interaction—they complement each other, intertwine, shape the students' musical experience and musical thinking, and lead toward an understanding of musical concepts.

Relying on the findings of numerous authors that pitch discrimination is a key attribute of musical ability (Gordon 1997, as cited in Bačlija Sušić 2016; Radoš, 2010), as well as on the understanding that, in accordance with the stages of children's cognitive development, visual and bodily-kinesthetic representation of musical concepts is necessary in the initial stage, we have pointed to the importance of using movement through the example of perceiving pitch. The significance of pitch-perception ability for the successful implementation of teaching in lower grades is also illustrated by the continuous presence of this curriculum requirement in music education at the preschool and early primary school levels. Building on the firmly established foundations of affective and perceptual experience in the first two grades, the differentiation of pitches continues during the melodic training of third-grade students, where movement serves as a didactic tool for identifying two pitch levels and their mutual relationship. Miletić emphasizes that the skill of decoding pitch within a particular musical context—rather than focusing on an isolated pitch—is essential for understanding complete musical thought, larger musical units and forms (Miletić, 2014). Moreover, the use of movement, according to Kilpatrick (2020, as cited in Tanasković 2022, p. 406), significantly enhances improvement in pitch discrimination. "The age corresponding to the third and fourth grades of primary school is considered highly favorable for developing this skill" (Miletić 2014, p. 3).

When upward hand movements are used to demonstrate a higher pitch, or conversely, lowering the hand indicates a lower pitch, the movement functions as a cognitive tool that mediates between the auditory information and its transfer to an internal mental level (Vukićević & Petrović, 2020). Movement in this context may be used in two ways. In the first case, movement replaces a verbal response when perceiving higher or lower pitch, with the corresponding movement predetermined in advance (e.g. raising the hand for a higher tone). Incorporating movement as a method of reporting the perception of pitch is applied during the phase of music literacy development when students have already learned pitch differences but are not yet writing them down in the form of musical dictation. Although this method of identifying pitch can be applied at the preschool level (Vukićević & Petrović, 2020), the validity of this technique becomes debatable given the characteristics of children's cognitive development and their limited ability to focus attention on two elements simultaneously—in this case, auditory perception and demonstrating that perception through movement (Radoš, 2010).

The second concept involves practicing a pre-designed choreography in which hand movements follow the type of melodic line or direction of motion—an upward melodic movement is accompanied by raising the hand, stepping forward and similar motions. When performing a vocal composition, movements that follow the melodic line may also vary depending on the initial pitch of the verse—for example, clapping hands for a phrase that begins on the tone sol, snapping fingers for a phrase that begins on a higher tone and tapping the thigh for a lower tone in relation to the beginning of the previous verse (Vukićević & Petrović, 2020). The choreography is acquired by demonstrating and practicing the prescribed movements and it can be applied at different ages (in preschool groups, and in the first and second grades). The teacher's task is to select an appropriate song and create a choreography that must be prepared in advance and demonstrated to the students before the performance. Compared to the use of movement in perceiving higher or lower pitch, performing a choreography, with emphasis on coordinating movement with the initial pitch of each verse, is a simpler task for students. This is further supported by students' familiarity with the requirement to use different movements while performing rhymes; for example, if they perform the rhythm of a rhyme by clapping palm to palm, they must use a different movement (finger snapping, stomping) to emphasize the beat (Bratić & Filipović, 2001).

In this case, although performing the choreography represents a predetermined and assigned activity, students spontaneously develop the ability to perceive the melodic line. The development of this perceptual ability is encouraged by the specific organization of activities in accordance with the cognitive aspects of musical development, which simultaneously contain familiar elements (Happy Birthday song) and a new task (performing a choreography that serves as an instructional exercise/movement game for following the melodic line).

In the area of rhythm and students' rhythmic education, movement has the most evident role compared to other segments of music education. This is confirmed by a considerable number of studies that examine this aspect of music teaching, often in the context of applying the Dalcroze approach (Anderson, 2011). Connecting movement with rhythm in music education occurs spontaneously, almost automatically, "as an innate response to music" (Rhett, 2020, p. 16). It builds upon familiar experiences gained through various forms of creative expression, such as improvising rhythm using hand or body movements or by playing children's rhythmic instruments, as well as creating movements in accordance with the rhythmic component of a song or composition. Expression through movement represents an almost instinctive response to musical stimuli—primarily to rhythmic patterns, and then to the shape of the melodic line, the content of motifs and the structure of the musical piece. At a younger age, movement is used in the form of spontaneous rhythmic motions in the preparatory phase of learning, enabling students to experience time signature, the accented beat and various note durations. In the next stage, when these concepts are introduced in the third and fourth grades, students are required to accurately reproduce rhythmic durations—an activity that precedes naming the new concept, understanding it and meaningfully applying it in another/new musical context. Hand movement can also be used in this stage of learning to mark rhythm, as an equivalent to musical notation.

By integrating movement and musical activities, the necessary foundations are laid for later understanding of music and musical notation, as Carl Orff concluded as early as the first half of the 20th century (Rhett, 2020). His concept, still frequently cited today, involves connecting music and movement in a natural, rational and effective way, with one of its aims being the encouragement of

musical literacy. Orff, Kodály, and Gordon—following Dalcroze, who was the first to highlight the use of movement in music education at the beginning of the 20th century—"advocated for the importance of using movement in musical development, especially in the early stages of learning music" (Čoksi et al., 1986, as cited in Papazachariou-Christoforou, 2022).

Papazachariou-Christoforou particularly emphasizes Gordon's (2003) viewpoints as significant for students' rhythmic education, noting his emphasis on the role of movement in understanding rhythm—from engaging the whole body and spontaneous movement 'to movements synchronized with rhythm, such as clapping, tapping, finger counting and marching' (Papazachariou-Christoforou, 2022). As seen in the described examples, this role has remained significant and unchanged even in the contemporary educational context. Kinesthetic experiences contribute to more effective learning and understanding of music, its meanings and the development of rhythmic abilities in younger school-age children.

Application of movement in the area of Listening to music

The simplest form of integrating music and movement is expressing oneself through movement under the influence of a listened composition. Authors Vidulin, Zauhar and Plavšić state that a young child experiences music on an emotional level, and that movement is only one of the ways they may react to the composition they listen (Vidulin, Zauhar & Plavšić, 2020, p. 47). However, in the field of listening to music, movement as a didactic tool has a more complex role. As Vujošević points out, numerous studies confirm that hand movements reflect the level of students' auditory perception more precisely than their verbal answers regarding the elements perceived in the listened composition (Vujošević, 2013, p. 109). In the scientific study by Debra Campbell, presented in the cited work, the necessity of using movement as an appropriate form of expression, or a medium, for measuring students' achievement during analytical listening is emphasized (Vujošević, 2013, p. 106). Perceiving musical characteristics is a key component of experiential-analytical listening and of students' ability to actively listen to music. Movement should follow the musical flow and "serve as an indicator of the tempo, expression and character" of the listened composition (Kršić Sekulić, 2006, p. 120). The expression of impressions and emotional experience in the lower grades should be given priority over directing attention toward the structural elements of a musical piece, as author Vidulin consistently highlights in her studies (see Lovrinić, Goldin & Vidulin, 2022; Vidulin et al., 2020). Although we agree with this standpoint, the curriculum requirements for the Teaching music in Serbia mandate that students be trained to perceive musical elements in the listened composition. Hence, this chapter discusses the use of movement in the domain of listening to music with the aim of recognizing specific musical phenomena, as well as the boundaries of a musical phrase and the characteristics of its melodic or rhythmic component.

Students of younger school age are expected to recognize the divisibility or indivisibility of musical form based on observed musical phrases, contrasts and repetition of musical material. As part of developing students' listening skills, movement is pre-designed for a specific musical phrase in the composition and students' attention is directed toward perceiving rhythmic–melodic characteristics, identifying the end of a phrase and the beginning of a new one, and performing the movement that corresponds to these musical characteristics. In this paper, special emphasis is placed on the possibility of perceiving the melodic–rhythmic component, given that the perception of other elements of musical expression is considerably simpler for students. In this context, movement serves as an indicator of students' level of knowledge and ability to recognize elements of musical expression in the listened composition, that is, as a "reflection of the level of musical cognition occurring in their minds" (Ferguson, 2005, as cited in Tanasković, 2022, p. 404). As already noted in the example of identifying pitch, the question remains to what extent movement can be considered a valid means of assessing students' abilities and knowledge, given the characteristics of cognitive aspects of musical development and the dependence of movement perfoming on basic motor skills such as mobility, precision and coordination. On the other hand, every group of students includes individuals who prefer a kinesthetic learning style based on movement and various physical activities, and for whom the described approach enables greater enjoyment in the learning process and longer retention of acquired content.

An important component of this approach is the selection of the musical piece. It is recommended that these be movements from Wolfgang Amadeus Mozart's piano sonatas (the Rondo from the Piano Sonata K. 309, the first movement of the C-major Facile Sonata), according to several criteria:

The sonata belongs to the domain of absolute music, which contains no descriptive elements or extramusical associations.

Piano music is most suitable for younger school-aged students, and we assume that orchestral color would significantly affect students' musical perception and their ability to focus on recognizing the melody.

Mozart's compositional style is characterized by simplicity, melodic cantability, balance and clarity. "His works emphasize melodic beauty, formal perfection and the expressive richness of harmony, texture and tone color. Mozart's music has a logical flow" (Portowitz 2001, as cited in Tanasković, 2014, p. 16).

The specified characteristics of Mozart's music not only enable students to easily recognize musical phrases but also help teachers design appropriate movements for clearly defined musical phrases in the listened composition.

The possibility of applying movement in the field of listening to music in the previously described manner points to a significant connection with Dalcroze's approach, particularly with his strategies of improvisation and eurhythmics (Parker, 2018). Based on the observed similarities between the methodological approaches used in contemporary teaching in Serbia and Dalcroze's concepts, as well as the approaches of other authors from the previous century (Orff, Kodály, and Gordon, according to Papazachariou-Christoforou, 2022), we conclude that there is no clear boundary between old and new methods and approaches. Accordingly, contemporary music education must strive to establish a balance between the traditional and the modern in all aspects and stages of the music education process.

Conclusion

Connecting music with movement is one of the frequently studied aspects of music education for younger primary school students in the broader educational context (see Anderson, 2011; Juntunen & Sutela, 2023). In addition to creating a favorable and positive classroom atmosphere, "the integration of movement activities into the educational process, in accordance with a specific thematic unit of the curriculum, makes learning new content more effective and positively influences the learning process" (Kolodziej-ski et al., 2014, p. 663). Moreover, most authors, both from Serbia and from other countries, identify the well-known concepts of Kodály, Orff, and/or Dalcroze as the main reference frameworks for studying the role of movement in music education.

Starting from the presented viewpoints and the posed research questions, this paper has outlined methodical approaches based on movement that can be applied in contemporary teaching for the acquisition of musical concepts in the area of music performance, as well as the perception of musical phenomena in the area of listening to music. The given examples of teaching specific musical concepts, along with the methodical approaches predominantly represented in the methodological literature and scientific works of authors who study the process of music learning in the first four grades of primary school in Serbia and other European countries, clearly imply the need of younger children to connect musical content with movement. We conclude that the integration of music and movement—both in the area of Music performance and in the area of Listening to music—is realized in two fundamental ways.

The first way is the spontaneous expression of a musical experience of a particular of musical components (rhythm, melody, tempo, character), where the movement demonstrates the perceived characteristic of the given element, without any verbal statements about whether the melody ascends or is wave-like, whether a certain phrase is repeated, and so on. This approach is applied in all teaching areas: listening to music, music performance and children's musical creativity. Although it represents the initial phase in the learning process, this approach based on integrating music and movement is only the basic level of pedagogical work in music education—one that should, through clear methodological guidance, be further developed toward the conscious perception and understanding of a specific musical concept or phenomenon.

The second way of connecting music and movement involves a predetermined task. For example, in the case of assigned rhythmic movements, the teacher identifies in advance the shared properties of the designed movement and the musical fragment, and the aim of this approach is to direct students'

attention toward coordinating these components and to prepare them for integrated learning of more complex concepts at the next stage of music education. Students perceive the demonstrated movements as movements that carry meaning, and remembering these movements becomes a cognitive task for them (Marjanović & Lalović 2006, p. 462). Knowledge acquired in this way is more functional, stored permanently in the students' memory and experience, so that it can later be reactivated, reconstructed and enriched with new aspects of studying, understanding and application in different musical contexts. It is precisely in these two modalities of applying movement in music teaching, the spontaneous and the assigned movement, that we recognize an analogy with Dalcroze's approach, which is oriented toward achieving a balance between kinesthetic and cognitive aspects, as well as between intentional and spontaneous expression of rhythm through movement (Anderson, 2011).

As we have seen in the presented examples, movement is an integral part of the methodological procedure which can be applied in perceiving and distinguishing pitch in the field of music performance, as well as in perceiving musical elements/phenomena in a listened composition. In addition, movement is an important component of the preparatory stage of playing children's rhythm instruments, which by definition involves manual movement and contributes to aspects such as emphasizing the rhythm of the composition, experiencing the beat, distinguishing between accented and unaccented parts of the measure and highlighting key segments of the composition. By applying this approach, students become capable of recognizing the importance and role of rhythm in the shaping of melody, the organization of pitch and in emphasizing significant moments of the melody.

The same methodological principles can be applied in the realization of other content as well, whereby in addition to curriculum requirements, age-related characteristics and the cognitive aspects of students' musical development, the teacher represents an important link in the process of learning, developing musical literacy and understanding music.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Data Availability Statement: If the data is accessible, authors should specify where it can be found and provide the relevant link (e.g., in a public repository or as supplementary material). If the data is not publicly available, authors should explain how researchers can request access to the study's data. In cases where data sharing is not possible due to confidentiality, ethical restrictions, or other limitations, authors should clearly state the reason and provide a detailed explanation

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Implementing Cognitive and Meaningful Learning Taxonomies in Visual Art Education Methodology

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Abstract

Contemporary educational processes are grounded in theoretical frameworks that support student learning. These frameworks serve as conceptual guidelines that define standards for teaching and learning in each period and are essential for ensuring the quality education of students – future educators in all fields. The effectiveness of students' practical work largely depends on these foundations. In this context, in order to provide high-quality conditions for the implementation of the academic curriculum, and especially for students' practical training, teaching strategies come to the forefront.

The purpose of this research is to analyze the implementation of aspects of Bloom's *Taxonomy of Cognitive Learning (Educational Objectives)* and Fink's *Taxonomy of Significant Learning* in order to gain meaningful insights into students' approaches and understandings. These insights are expected to be valuable for the faculty in developing learning objectives and improving learning outcomes within the curriculum.

The objectives of the research focus on examining the quality of teaching in the courses *"Foundations of Art Education with Methodology"* and *"Foundations of Art Instruction with Methodology"* for the groups of primary classroom teaching and preschool education at the Faculty of Pedagogy "St. Kliment Ohridski" in Skopje, Ss. Cyril and Methodius University in Skopje. Our interest is directed toward determining whether the academic curriculum of these courses is designed to develop students' attitudes, skills, and knowledge within a contemporary social context.

Keywords: Educational taxonomies, Instructional processes, Future teachers' professional competencies.

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Introduction

Bloom's *Taxonomy of Cognitive Learning (Educational Objectives)* and Fink's *Taxonomy of Significant Learning* represent contemporary and highly relevant theoretical perspectives, with exceptional capacity for practical implementation in the everyday processes of teaching and learning intended for students – future teachers and educators.

The analysis of the implementation of both taxonomies as methodological tools provides examples of action verbs suitable for designing goal-oriented activities for students. These activities can be adapted across educational levels and are applicable both for pupils in primary classroom teaching and for children in early childhood education.

The hierarchical structure of six levels in Bloom's *Taxonomy of Educational Objectives* is widely used in education to establish clear and measurable learning goals that correspond to different levels of cognitive complexity and learning (Bloom et al., 1956).

Fink's *Taxonomy of Significant Learning* is a framework that offers holistic learning goals and, unlike Bloom's taxonomy, represents a cyclical model of learning that extends beyond traditional cognitive aspects. It provides learning opportunities designed to connect with students at a deeper, emotional level, ultimately guiding them to become active creators in their own educational process (Fink, 2013).

The teacher represents the foundation of a successful educational process, and attention to teachers' work and the development of their skills is placed at the highest level of priorities. It is considered a central element in building students' competencies for life in the 21st century.

Our contemporary era is characterized by the rapid acceleration of knowledge, technology, and continuous change across various fields. These immediate and large-scale changes require the ongoing development of teachers' capacities and professional knowledge. This cannot be achieved unless teachers possess a genuine love for learning, a strong commitment to knowledge acquisition, and a desire to innovate and give their best.

One of the most important ways to ensure teachers' success in aligning teaching objectives with the needs of their students is professional development. In its purpose, professional development differs from methods such as teacher supervision and evaluation, as it focuses on teachers' growth in practice rather than only on teaching efficiency and quality. Professional development emphasizes the processes through which teachers build their professional identity and interact with students, and how these interactions are reflected in their classroom performance. Therefore, the primary goal of professional development is the improvement of teaching quality, resulting in high-quality education for all participants.

Accordingly, the preparation of teachers and their support in professional and material development occupy a special place in the educational planning processes of Ministries of Education worldwide, until teacher and administrative training evolves into sustainable professional development.

Literature Review

Characteristics of Educational Taxonomies

Over the past several decades, higher education has undergone a major paradigm shift: the idea of the university as a place primarily focused on delivering instruction has largely been reimagined as a space for the implementation of learning (Barr & Tagg, 1995). Research in the emerging and interdisciplinary field known as the *learning sciences* has been a key driver of this transformation. Scholars in this field have advanced understanding of learning and cognition by drawing insights from disciplines such as cognitive neuroscience, human–computer interaction, linguistics, and sociology.

As part of this evolving landscape, curriculum design experts and specialists from related fields have developed numerous frameworks and models for teaching and learning. These frameworks are research-informed and can serve as guidelines or conceptual maps for educators and academic departments engaged in the design or redesign of courses.

Learning taxonomies represent scholarly attempts to characterize different types of learning, much like scientists use taxonomies to classify different types of organisms - educational psychologist Benjamin

Bloom and his colleagues proposed a system for classifying educational objectives that has become widely adopted.

By adding a knowledge dimension**,** Anderson et al. identified four distinct types of knowledge: factual, conceptual, procedural and metacognitive knowledge.

By including this final category—metacognition—the authors emphasized the importance of students' awareness of their own thinking processes, a point at which cognitive and social constructivist models of learning converge.

To evoke and develop student`s awarness about the learning proceses, we introduce students – future teachers in detail with two most widely recognized learning taxonomies:

- Bloom's Taxonomy of Educational Objectives
- Fink's Taxonomy of Significant Learning

Comparison of the Taxonomies

Bloom's Taxonomy of Cognitive Learning and Fink's Taxonomy of Significant Learning guide educators in developing learning goals, program learning outcomes, course-level learning objectives.

Their combined use enables teaching to be intentionally designed to develop students' attitudes, skills, and knowledge. Bloom and Fink created two taxonomies whose intersection provides examples of action verbs suitable for both teaching and learning levels.

Understanding the similarities and differences among these educational concepts is a key path toward creating high-quality educational programs and strategies. The implementation of different elements leads to continuous quality improvement.

Bloom's Taxonomy

A group of educational researchers led by Dr. Benjamin Bloom developed a model of educational objectives in the 1950s to improve critical thinking in schools, revised in 2001 by Anderson & Krathwohl. This taxonomy with hierarchical organization of cognitive skills into six levels became one of the most influential ideas in education. The framework of lower-to higher-order thinking skills became a foundational approach in the development and formulation of learning outcomes.

According to Bloom, there are three domains, or basic types, of educational objectives:

- Cognitive domain – the acquisition of knowledge, including mental processes such as memory, recall, and analysis
- Affective domain – interests, values, emotions, and attitudes toward learning
- Psychomotor domain – actions and motor skills that students are expected to learn

Taxonlomy initially focused on the cognitive domain and identified six hierarchical levels of objectives: knowledge, comprehension, application, analysis, evaluation and creation.

Significance of the Bloom's Taxonomy is the fact that it remains a useful framework for defining learning outcomes and designing learning activities, assessment, and constructive alignment. With its classification of verbs (remember, understand, apply, analyze, evaluate, create, etc.) in a hierarchical structure, it helps identify what students must be able to *do* to demonstrate learning, supporting the development of real-world and authentic skills.

Learning outcomes based on the Bloom's taxonomy help teachers to:

- Plan and create appropriate instruction, guidance, and teaching strategies
- Design valid tasks and assessment strategies
- Ensure alignment between instruction, assessment, and learning goals (Anderson et al., 2001)

Fink's Taxonomy of Significant Learning

A popular alternative to Bloom's taxonomy is L. Dee Fink's Taxonomy of Significant Learning. Unlike Bloom's, Fink's taxonomy is non-hierarchical, with each element interacting with the others to "stimulate other kinds of learning" (Fink, 2005). Fink also includes elements that would be classified as "affective" in Bloom's taxonomy, such as Caring and the Human Dimension recognizes also the importance of metacognition as a dimension of learning.

Six Dimensions create Fink's Taxonomy: Foundational Knowledge, Application, Integration, Human Dimension, Caring and Learning How to Learn.

As Bain (2012) writes: *"Dee Fink challenges our conventional assumptions and practices and offers an insightful approach to expanding our learning goals, making higher education more meaningful. This is a gem of a book that every teacher should read."*

Fink provides invaluable conceptual and procedural tools for designing instruction. Step by step, he shows how to use the taxonomy of significant learning and systematically combine research-based best practices with learner-centered teaching strategies, resulting in powerful learning experiences.

He defines how people learn, what active learning is, and how student engagement across different dimensions leads to significant learning. The use of knowledge, tools, and strategies in creating significant learning experiences empowers educators to creatively design courses that result in meaningful learning for students.

Approaches to implementation of Educartional Taxonomies in the Curriculum Design

Traditional Curriculum Design

Many instructors begin course design by focusing on content (texts and readings) and cognitively oriented activities, without sufficient attention to inclusivity or multiple learning pathways: create or adapt course content, plan assignments and tests, define assessment procedures and translate content into curriculum-focused goals.

We were waware that this approach has two major limitations:

- It often leads to activities chosen for being fun or interesting rather than educationally valid
- It attempts to cover too much content in too little time without highlighting key ideas.

That is why we used **Backward Design Approach, that was designe by** Wiggins and McTighe overcome these limitations:

1. **Identify desired results** – What knowledge, skills, and abilities should students possess by the end of instruction?
2. **Determine acceptable evidence** – What evidence will document and evaluate students' learning?
3. **Plan learning experiences and instruction** – What activities and guidance will help students demonstrate their learning?

The development of these methodologies is directly connected to the use of educational taxonomies, which serve as a foundation for critical analysis and continuous improvement by contemporary scholars.

Aim of the Research

The subject of this research is the implementation of the concepts of Bloom's *Taxonomy of Cognitive Learning (Educational Objectives)* and Fink's *Taxonomy of Significant Learning* in the delivery of the academic curriculum in the field of Art Education for students at the Ss. Cyril and Methodius University in Skopje, Faculty of Pedagogy "St. Kliment Ohridski". The study analyzes the strategies of their implementation within the academic curriculum for students future primary and preschool teachers.

Purpose of the Research

The purpose of this research was to examine the influence of the concepts of these two contemporary taxonomies of educational objectives on the planning of practical teaching for students – future teachers and preschool educators – in the course *"Art Education with Methodology"*. The study seeks

to understand how effectively the curriculum promotes higher-order thinking skills, creativity, reflective practice, and the ability to transfer theoretical knowledge into practical teaching scenarios.

A specific objective is to define strategies for their active use in the teaching process within higher education systems.

Research Objectives

1. To examine which aspects of Bloom's *Taxonomy of Cognitive Learning (Educational Objectives)* and Fink's *Taxonomy of Significant Learning* are included in the theoretical content of the academic curriculum.
2. To explore whether strategies for applying these concepts exist during the implementation of lectures, activities, and practical exercises in the training process of future teachers in the course *"Art Education with Methodology"*.
3. To investigate which competencies are developed in students through the integration of these different concepts.

Research Hypotheses

Main Hypothesis

The implementation of contemporary taxonomies of educational objectives in the teaching of *Methodology of Art Education* within the academic curriculum for students – future teachers and preschool educators – has a significant impact on the acquisition of essential competencies.

Hypothesis 1

The university curriculum enables the implementation of contemporary taxonomies of educational objectives in teaching the subject area of *Methodology of Art Education*.

Hypothesis 2

The concepts of Bloom's *Taxonomy of Cognitive Learning (Educational Objectives)* and Fink's *Taxonomy of Significant Learning* within the curriculum enhance students' understanding of educational processes.

Hypothesis 3

Knowledge of strategies for the application of contemporary taxonomies of educational objectives enables the acquisition of functional knowledge and abilities.

Hypothesis 4

The implementation of the concepts of Bloom's and Fink's taxonomies encourages the active participation of students – future teachers and educators – during lectures and practical exercises.

Research Sample

The research included 57 fourth-year students from the Faculty of Pedagogy "St. Kliment Ohridski" in Skopje, from the primary classroom teaching and preschool education study programs, during the 2023/2024 academic year.

Method

This research has both theoretical and empirical characteristics; therefore, the selected methods, techniques, and instruments are considered appropriate for obtaining the expected results.

Research methods: theoretical content analysis of the academic curricula; descriptive method to explain foundations and contemporary methodological approaches; comparative method to analyse obtained results.

Concept for designing student questionnaires:

The main idea was to analyze students' responses related to their knowledge and awareness of educational taxonomies - both structured and open-ended formats.

Findings

Results of theoretical analysis of the content of academic materials for theoretical preparation of students

The analysis confirmed that the implementation of aspects of Bloom's *Taxonomy of Cognitive Learning (Educational Objectives)* and Fink's *Taxonomy of Significant Learning* is an integral part of the academic foundation courses, such as *General Pedagogy* and *Didactics*, with a particular emphasis on educational taxonomies from a theoretical perspective.

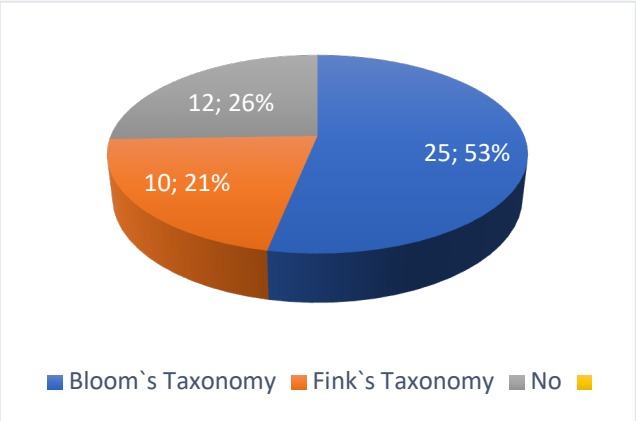
At the same time, other analyzed curricula from methodologically oriented courses introduce the understanding and application of taxonomies in a way that is appropriate to each subject area, including: *Foundations of Art Education with Methodology*, *Methodology of Mathematics 2*, *Methodology of Natural and Social Sciences 2*, and *Methodology of Teaching Macedonian Language 2*.

The implementation across these subject areas represents a synergy between lectures and practical exercises, through which students are actively engaged, both directly and indirectly, in the realization of these concepts.

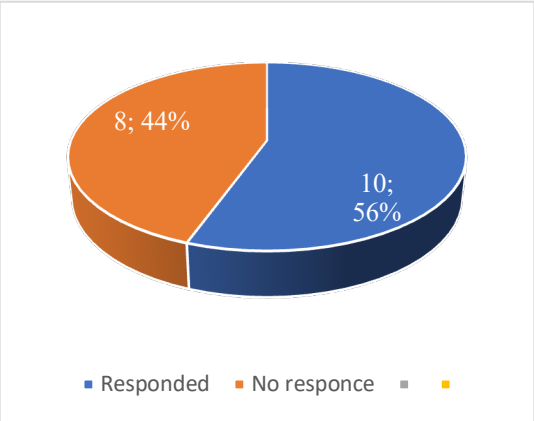
Through this analysis, Hypothesis 1 was confirmed:

The university curriculum ensures the implementation of contemporary taxonomies of educational objectives in the teaching of the Methodology of Art Education.

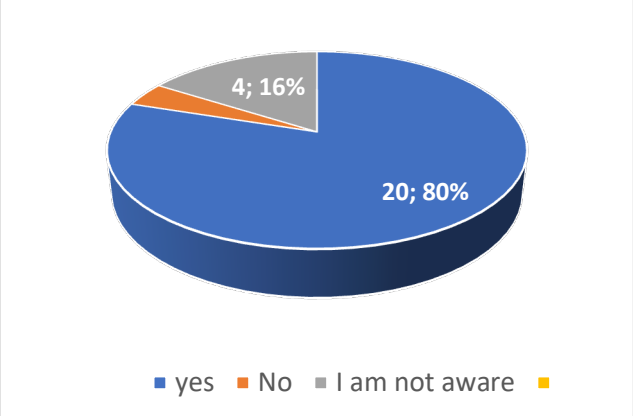
Results from the student questionnaires



Graphic 1.
Student`s awarnes of educational taxonomies



Graphic 2. Application of educational taxonomies in student`s practical work

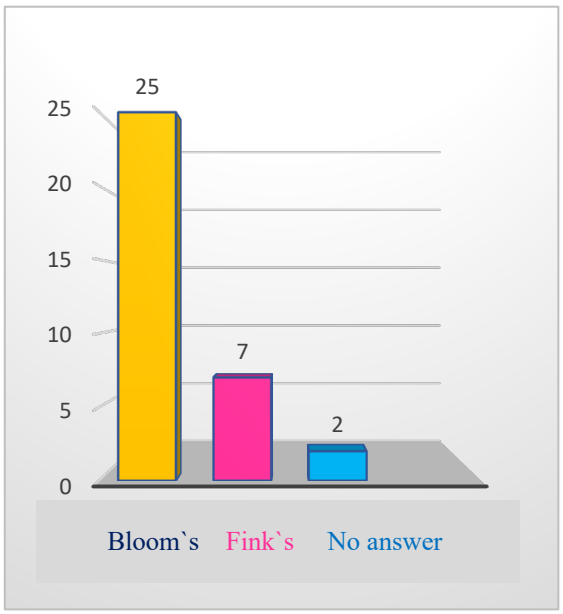


Graphic 3.

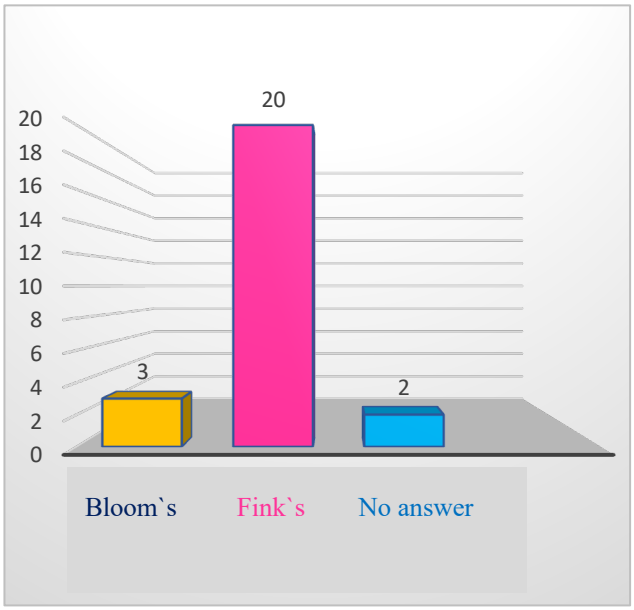
Taxonomies of educational objectives and processes

of stimulating active perception in pupils

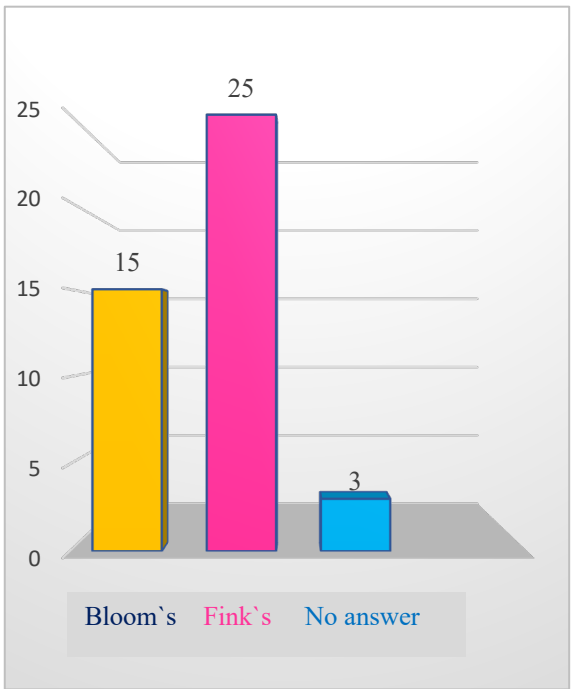
Question: Label the skills you have included in your daily preparation and implementation of the practical teaching? (multiple answers possible, specify taxonomy)

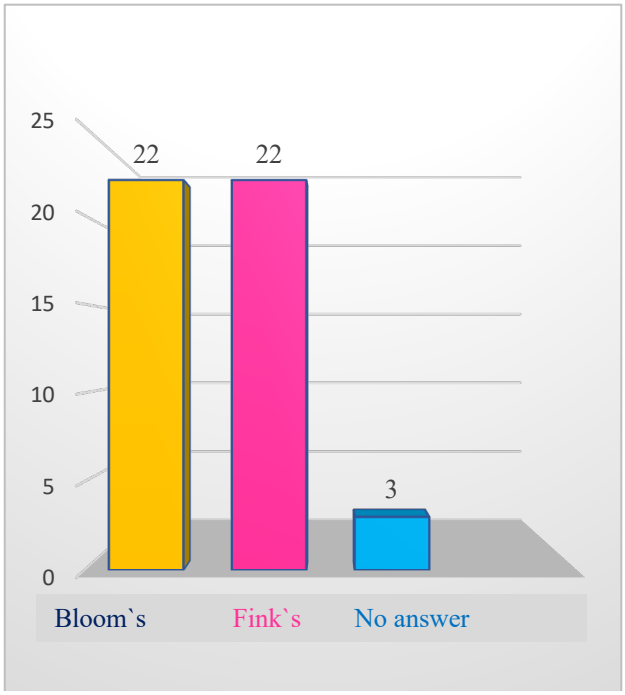


Graphic 4. Enabling and supporting student`s understanding of the proceses of learning



Graphic 5. Care





Gaphic 6.

Human dimension and management of emotions

Graphic 7.

Monitoring the individual cognitive and creative development of students/childre

Discussion, Conclusion, and Suggestions

Analysis of Students' Responses

The analysis of the questionnaire data enabled the examination of the relationships between students' responses and the proposed research hypotheses.

Hypothesis 1.The university curriculum ensures the implementation of contemporary taxonomies of educational objectives in the teaching of the Methodology of Art Education.

This hypothesis was supported by the responses to Question 1: "During your studies, did you receive guidance on the implementation of contemporary taxonomies of educational objectives?" A substantial proportion of respondents, 70.21% (33 out of 47 students), provided affirmative answers, indicating that the majority of students perceived the presence of such guidance within their academic training.

Hypothesis 2.The concepts of Bloom's Taxonomy and Fink's Taxonomy included in the curriculum enhance students' understanding of educational processes.

This hypothesis was initially partially supported by the responses to Question 2: "Can you name any educational taxonomies?" In this case, 53% of students (n = 25) explicitly identified Bloom's Taxonomy, while 21% (n = 10) provided generally positive responses without specifying particular frameworks.

Further evidence was obtained from the responses to Question 3: "Which characteristics of Bloom's Taxonomy of Cognitive Learning are you familiar with?" The data indicated that 76% of respondents identified key characteristics of Bloom's Taxonomy, while 24% identified characteristics consistent with Fink's Taxonomy. Taken together, these findings provide sufficient empirical support for the confirmation of Hypothesis 2.

Hypothesis 3.Knowledge of strategies for the application of contemporary educational taxonomies facilitates the acquisition of functional knowledge and professional skills.

The responses to Question 4 ("Which characteristics of Fink's Taxonomy of Significant Learning do you apply in your daily lesson planning?") revealed that 56% of students correctly identified applicable characteristics, whereas 8% of respondents did not provide an answer, which may indicate limited familiarity or lack of practical application.

Additional support for this hypothesis was derived from Question 5: "Did the structure of the daily lesson plans in the course 'Art Education with Methodology' enable the implementation of educational taxonomies and increase your confidence in stimulating active perception among pupils/children?" In this case, 80% of respondents (n = 20) reported positive effects, while 10% (n = 4) responded negatively. These findings confirm that knowledge and strategic use of educational taxonomies contribute significantly to the development of functional knowledge and teaching competencies, thereby confirming Hypothesis 3.

Hypothesis 4. The implementation of Bloom's and Fink's taxonomies promotes active engagement of students – future teachers and educators – during lectures and practical exercises.

This hypothesis was supported through a comparative synthesis of responses to Questions 3, 4, and 5. The high proportions of students demonstrating familiarity with Bloom's characteristics (76%), correct application of Fink's taxonomy (56%), and positive perceptions of increased engagement and confidence (80% affirmative responses) collectively indicate that the implementation of these taxonomies fosters active student participation. These results provide strong empirical support for Hypothesis 4.

Main Hypothesis

The main hypothesis was evaluated through responses to Question 6: "Which of the following abilities did you include in your preparation and implementation of practical teaching?" The data demonstrated that students intentionally incorporated taxonomy-based competencies, as follows:

Understanding of learning processes: 53.19% aligned with Bloom's taxonomy and 14% with Fink's taxonomy;

High-quality presentation of learning content: 48% reported the use of action verbs associated with Bloom's taxonomy;

Caring (affective dimension, Fink): 42.5%;

Human dimension and emotional management (Fink): 53.19%;

Monitoring individual cognitive and creative development of pupils/children: 93.6% (n = 44) reported the integration of elements from both taxonomies.

These findings demonstrate that the implementation of contemporary educational taxonomies has a statistically and pedagogically significant influence on the development of essential professional competencies among students, thereby providing strong confirmation of the main hypothesis

Conclusions

Students confirmed that use Bloom's and Fink's taxonomies in their daily plannings in preparation for practical work because these frameworks provide structured ways to understand, categorize, and deepen their learning experiences. They rely on this structured ways of methodical preparations that anable them to focus on the pupl`s learning processes.

The analysis leads to the following key conclusions:

1. Organization of Learning Objectives

Students confirmed that Bloom's taxonomy helps students progress from basic knowledge to higher-order thinking. Fink's taxonomy promotes a holistic view of learning. Together, they enable structured, deep, and organized learning.

2. Promotion of Higher-Order Thinking Skills

Both taxonomies encourage analysis, synthesis, creativity, and real-world application, making students more adaptable and capable of solving complex problems.

3. Support for Holistic and Meaningful Learning

Fink's taxonomy integrates emotional, social, and personal development, while Bloom's taxonomy supports a sense of achievement through cognitive progression.

4. Goal Setting and Self-Assessment

Both frameworks help students set clear goals, monitor progress, and take ownership of their learning.

5. Adaptation to Contemporary Learning Demands

Bloom's taxonomy offers a well-established structure, while Fink's taxonomy emphasizes interdisciplinary thinking, social awareness, and practical relevance.

Educational taxonomies represent systematic frameworks that classify learning objectives, cognitive processes, and types of knowledge in order to support the design, implementation, and evaluation of teaching and learning. They provide a structured language through which educators can articulate what learners are expected to know, understand, and be able to do. In contemporary education, taxonomies are no longer viewed as static classification systems, but as dynamic conceptual tools that guide learner-centered, competency-based, and inclusive pedagogical practices.

Historically, Bloom's Taxonomy established one of the most influential models for organizing cognitive learning outcomes, progressing from lower-order thinking skills such as remembering and understanding to higher-order skills such as analyzing, evaluating, and creating. The revised version of Bloom's taxonomy further expanded its relevance by integrating dimensions of knowledge and cognition, thus enabling educators to design learning experiences that are aligned with real-world problem solving, creativity, and critical thinking.

Contemporary learning environments, however, demand more than cognitive mastery alone. Rapid technological development, globalization, and changing social realities have shifted the focus of education toward holistic development, lifelong learning, and the formation of adaptable, reflective learners. In this context, alternative taxonomies, such as Fink's Taxonomy of Significant Learning, have gained prominence. Fink's framework expands the concept of learning by including dimensions such as the human dimension, caring, and learning how to learn, emphasizing the importance of emotional engagement, values, self-awareness, and personal meaning in the learning process.

In modern educational practice, the integration of taxonomies supports a shift from teacher-centered transmission of knowledge to student-centered construction of meaning. Taxonomies provide a foundation for backward design, competency-based education, and constructive alignment, ensuring coherence between learning objectives, teaching strategies, and assessment methods. They help educators design learning tasks that foster inquiry, collaboration, reflection, and authentic performance, rather than passive memorization.

Moreover, in contemporary learning, taxonomies function as tools for educational equity and inclusion. By clearly articulating progressive levels of learning and diverse domains of competence, taxonomies make learning pathways more transparent and accessible to learners with different backgrounds, abilities, and learning styles. They enable differentiated instruction and adaptive assessment, supporting learners in developing both academic and socio-emotional competencies.

In conclusion, taxonomies play a central role in contemporary education by bridging theory and practice. They offer a shared conceptual framework for designing meaningful, reflective, and transformative learning experiences. In a world characterized by constant change and increasing complexity, educational taxonomies remain essential instruments for cultivating critical thinking, creativity, social responsibility, and lifelong learning

Significance and Impact of the Research

This research provided scientific data on the implementation of Bloom's and Fink's taxonomies among students.

The students' opinions offered insight into their expectations and capacities to implement educational processes based on contemporary classifications and taxonomies.

Modern educators should build their professional growth on high-quality scientific knowledge and continuously adapt their work to the needs and abilities of new generations.

The results of this research are expected to provide direct and comprehensive guidance for improving teaching quality at the faculty and for its national and international presentation.

This research also creates a solid foundation for the systematic integration of social-emotional learning into the curriculum of the course Art Education with Methodology, both as theoretical content and as practical strategies and techniques applicable in everyday teaching practice.

The central guiding idea of this project is that the most contemporary global educational trends will enable students – future teachers and educators – to acquire high-quality and essential teaching competencies.

Additional Analytical Perspective: Students' Need for Further Support

Although the findings demonstrate a generally positive level of familiarity with and application of contemporary educational taxonomies, the results also reveal evidence of a need for more systematic and continuous pedagogical support. The fact that a portion of students were unable to identify or apply key characteristics of the taxonomies, and that a measurable percentage reported uncertainty or negative responses, suggests the presence of developmental gaps in both conceptual understanding and practical transfer of theoretical frameworks into teaching practice.
These findings indicate that students – future teachers and preschool educators – would benefit from more structured mentoring, scaffolded learning experiences, and repeated opportunities for guided practice in applying educational taxonomies within authentic teaching contexts. In particular, the integration of reflective practice, feedback-oriented supervision, and model-based instruction could strengthen students' professional confidence, critical pedagogical thinking, and their capacity to independently design lessons aligned with contemporary educational principles.

Furthermore, the data suggest that institutional support mechanisms, such as continuous professional development workshops, micro-teaching laboratories, and curriculum-based coaching, may play a significant role in bridging the gap between theoretical knowledge and practical competence. Addressing these needs is essential not only for improving students' academic performance, but also for enhancing their long-term professional readiness and their ability to respond flexibly to the complex demands of modern educational environments.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Data Availability Statement: If the data is accessible, authors should specify where it can be found and provide the relevant link (e.g., in a public repository or as supplementary material). If the data is not publicly available, authors should explain how researchers can request access to the study's data. In cases where data sharing is not possible due to confidentiality, ethical restrictions, or other limitations, authors should clearly state the reason and provide a detailed explanation

Conflict of Interest: NO

Generative Artificial Intelligence Statement: No AI-generated content.

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The Setting Of Teacher-Parent Communication Within The Framework Of Digital Technology

Florina Shehu[1] Tatjana Koteva Mojsovska[2]

Abstract

Teacher-parent communication has a special significance in education and the educational impact on the personality of students.In today's school reality, teacher-parent communication, among other things, takes place through the use of various digital tools, platforms, etc., which more or less influence the method, processes, and outcomes of the communication itself, indicating certain needs, opportunities, strengths, and weaknesses.Not every education system has equal or highly developed digital capabilities, systems, platforms, etc., which affects both the digital experience and professional training of teachers, but also their ability to properly and effectively use digital technology when communicating with parents.The challenges of the aforementioned issues are recognized in achieving quality, targeted communication and partnership with parents.Today, the establishment of teacher-parent communication through the use of digital technology is becoming an increasingly topical issue in pedagogical science, initiating the need for more substantial research into certain aspects of it, especially if a number of other factors that directly and indirectly influence it are taken into account.

The research problem concerns the consideration of certain aspects, advantages and difficulties of teacher-parent communication through the application of digital technology within education.The research methods are descriptive in nature, using certain approaches. Content analysis, a survey, and a semi-structured focus group interview with primary education teachers were applied.The sample is stratified, comprising 186 primary school teachers. The results indicate certain aspects that are important for the advancement and further scientific treatment of teacher-parent communication within the framework of digital technology.The conclusion of the research indicates the need for permanent research and the introduction of modern knowledge, approaches and, above all, cooperation of all relevant partie sand factors in achieving quality in teacher-parent communication when using digital technology.

Keywords: teacher-parent communication, digital technology, teacher, primary education

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Introduction

The introduction of digital technology in the communication between the teacher and the parent means the introduction of innovative ways of Concentration and partnership, as the highest level of cooperation between the aforementioned parties, but also between the municipalities and the family. Such an approach is in accordance with the temporal situation in which these societies exist and create, the educational systems and the areas function. However, in relation to the teacher-parent communication, the digital communication between the authority and the educational staff is associated with high academic achievements and educational expectations (Bouffard, 2008; Thompson, 2008). Also, some research has shown that what is considered social as parental involvement, is actually specific to the interests of the university, as institutions among other levels, and which are representatives of middle-class parents (Vincent & Martin, 2005; Nir & Bogler, 2012), something that is similar to some certain aspects of the social.

However, in terms of digital technologies, which are considered more efficient, effective, and convenient than traditional forms (Ho, Hung, & Chen, 2013; Olmstead, 2013; Blau & Hameiri, 2017; Wasserman & Zwebner, 2017), today most of the communication between the teacher and the parent takes place through digital platforms (Kuusimäki, et al., 2019) which can help the relationship between families and schools, through the active involvement of parents in the work of the school, and thus overcome certain obstacles that arise in non-digital communication, etc. (Bull, et al., 2008: Grant, 2011). Also, digital platforms in teacher-parent communication generally enable the exchange of information on all current issues, but also on more personal issues such as student progress, possible conflicts at school or learning difficulties (Carr et al., 2015; Palts and Kalmus, 2015), as well as strengthen partnerships between families and schools (Bacigalupa, 2016; Bardroff & Tann, 2012; Blau &Hameiri, 2012; Goodall, 2016; Kosaretskii & Chernyshova, 2013).

In accordance with the above, the subject of research in this paper refers to the consideration of the setting of the application of digital technology in teacher-parent communication in primary education in the Republic of North Macedonia. The aim of the research is aimed at understanding the attitudes and opinions of teachers about the types of digital technology used in their communication with parents. Analogous to the set subject and goal of the research, several hypotheses of the research have been set that relate to: planning of communication with parents in the annual (global) work plan; then the level of professional support and training of teachers in the application of digital technology in communication with parents; the effectiveness, usefulness and value of the applied types of digital technology in communication with parents; the advantages and limitations of the application of digital technology in communication with parents.

Literature Review

Teacher-parent communication within the framework of the assumptions of contemporary social conditions and environment in a narrower and broader sense of meaning, as well as the functioning of the entire education system, and especially of the school as the most widespread and socially responsible educational institution, undoubtedly represents a specific way of assessing the functioning and behavior (Shehu, 2024) of the same based on the established internal and external interactions (Stamatis, 2012: 2015; Pasiardis, 2004: Wilke, 1997). Teacher-parent communication, among other things, influences the support of good relations between the parties involved, which is a basic assumption for having true involvement (Graham-Clay, 2005; Kraft & Dougherty, 2013) of parents in achieving the set aspirations and creating cooperation (Gu, 2017) and partnership in achieving common educational, educational, social and other goals. The influence of teacher-parent communication has been proven in terms of increasing parental participation in the outcomes of the process of raising and educating their children - students, but also in building relationships, students' approach to problem solving, as well as connections with others, etc. (Grolnik, Friendly and Bellas, 2009). Undoubtedly, the existence of quality communication between teacher and parent also contributes to the development of the student's so-called "soft skills", preparation for working with others, ability to focus on the task, self-regulation, self-esteem, etc. (Heckman, 2011), and increasing their own academic achievements (Epstein, 2005; Henderson & Mapp, 2002; Jeynes, 2015; Park & Holloway, 2017; Wilder, 2014). However, a series of challenges often arise in terms of communication effectiveness (Ozcinar & Ekizoglu, 2013), starting

from research focused on determining the most significant factors that appear as causes of low-quality communication, including socioeconomic, cultural, linguistic factors, and the mismatch of communication time between teacher and parent due to different schedules (Garreta, 2015; Henderson & Mapp, 2002; Murray, McFarland-Piazza, & Harrison, 2015) of responsibilities and work. In the context of the above, in teacher-parent communication, the perceptions, expectations and beliefs of the people involved also play a significant role, proving that there is a strong connection between beliefs, decisions and actions (Rokeach, 1968; Ajzen, 1991, Fullan, 2001), although for certain aspects of teachers' practical actions, we cannot draw an equation, because the expectations, especially of teachers, are a process that begins from their initial education (Richards & Killen, 1994), and is built, changed, and supplemented through years of professional work and development.

The use of digital technology in teacher-parent communication represents one of the innovative ways of establishing and supporting quality communication. It happens that a change in beliefs follows, but it cannot be expected that changes in behavior will be influenced by previously changed beliefs, so it is not uncommon for teachers' beliefs to be out of line with their actual involvement in the digital world (Ertmer et al. 2012).

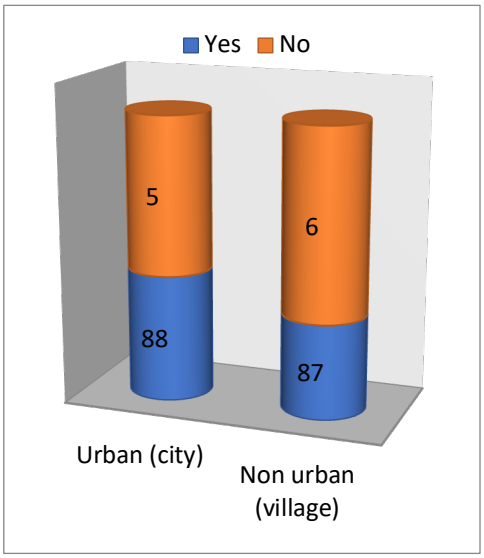
Method

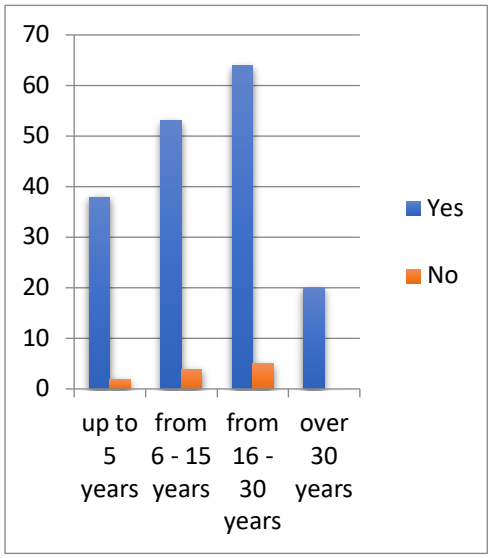
The research conducted is of a quantitative and qualitative nature, using descriptive and interpretive methods, through an analytical-descriptive, analytical-interpretive and analytical-comparative approach. The sample is stratified and intentional due to the coverage of three regions that have a larger population, while the research includes one hundred and eighty-six classroom teachers from twelve primary schools as central and five regional schools, with varying lengths of work experience and location of the school in which they work (urban and rural areas), from the Skopje, Kumanovo and Gostivar regions. Content analysis, a survey and a semi-directive interview conducted through five focus groups consisting of a total of twenty-five teachers were used as research techniques. The content analysis technique allowed obtaining knowledge of a theoretical nature (literature, legal and program content), in terms of the setting, approaches, research, etc., for the mentioned topic, as well as in the analysis of the results obtained from the conducted research, which contributed to objectivity in their interpretation. The applied survey instrument contains a total of 15 questions, and data relating to the intended nature of the sample (location of the school - urban or rural, and length of work experience), strictly respecting the principle of anonymity, and the remaining questions are of different types (multiple choice, open, closed and combined type). The semi-directive interview conducted with focus groups was conceptualized on the hypotheses set with the possibility of a broader treatment of the stated goal and objectives of the research and obtaining in-depth and more comprehensive knowledge. The validity and reliability of the research are observed through the number of covered grade teachers (from the first to the 5th grade of primary education) and schools in which teaching is conducted in Albanian, from the three largest populated areas in the northwest of the Republic of Macedonia. At the same time, a pilot test was conducted to check the quality of the research instruments (survey and semi-structured interview) with a sample limited to grade teachers from 3 primary schools who were not and are not included in the final research. The data obtained by applying the survey were processed using the SPSS.20 program, through the calculation of frequencies (f), expected frequencies (ft), percentage (%), chi-square test ($\chi 2$), statistical significance (p), frequency distribution (df), correlation coefficients (Phi, V, C).
The research was conducted in accordance with the stipulated ethical standards, with prior steps taken such as obtaining consent for research from the schools, timely reporting on the method of implementation, obtaining consent and voluntariness from the teachers for their involvement, by observing the conditions of confidentiality and anonymity.

Findings

The applied research technique, a survey of the primary school teachers included in the research sample, allowed us to obtain a series of insights into the above-mentioned issues. Due to the size of the paper, data from only a few relevant research questions are presented. The obtained data are presented in a more economical way, namely through a graphical presentation of the most striking answers, observing the specified categories of the specific research sample.The findings obtained in the research can be explained with tables, figures, graphics, or pictures in accordance with the purpose of the study.

When asked whether communication with parents through the use of digital technologies is planned in the annual (global) work plan, we received quite interesting data from the responses of the teachers included in the research, which we presented graphically and performed an appropriate analysis and interpretation (graph no. 1).

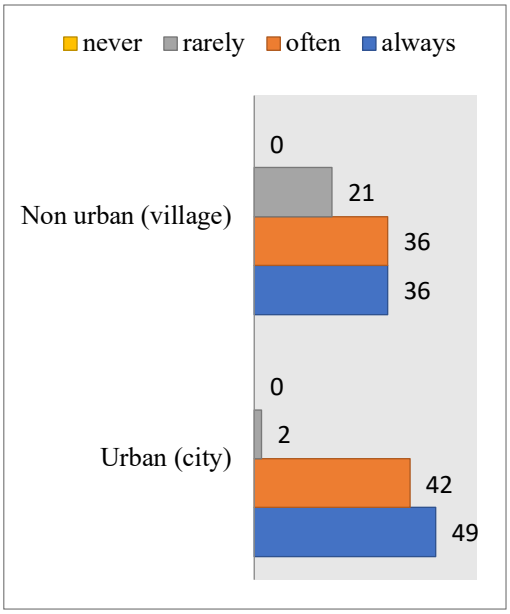


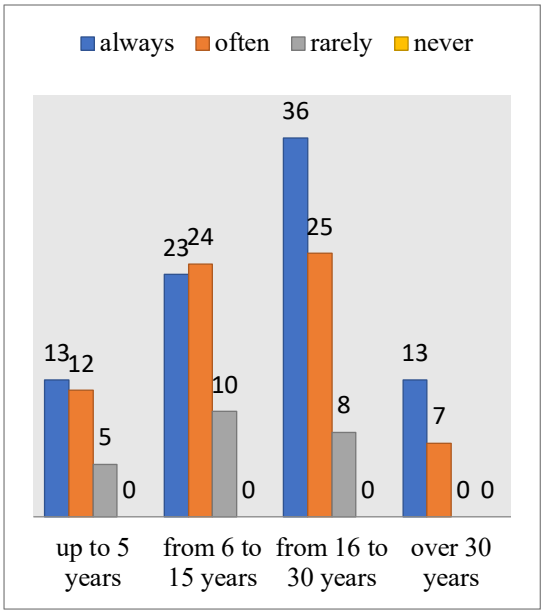


p=0 .756 χ^2= 0.97 Phi=-.023 V=.023 C=.023 p=0.645 χ^2= 1.602 Phi=.095 V=.095

Graph 1. Annual (global) Planning of Digital tools, Technologies for communication with parents

From the data obtained, we can see that teachers working in schools located in urban and rural areas, as well as with different lengths of work experience, in most cases, in their annual (global) work plans, plan the types and tools of digital technologies when communicating with parents, which is an important aspect in terms of teachers' professional approach to communicating with parents in today's modern conditions and needs.





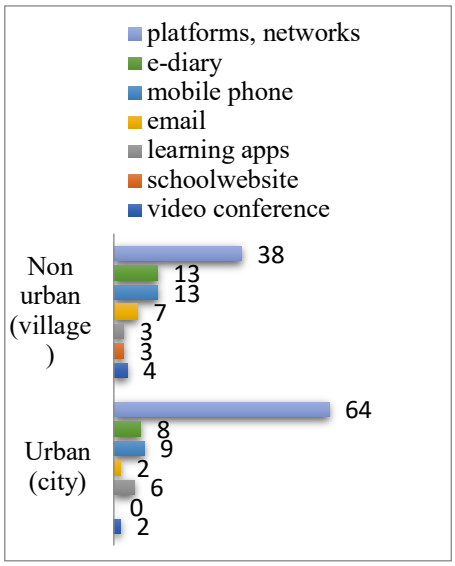
School location
p= .000 χ^2 = 18.145 Phi=0.312 V=0.312 C=0.298

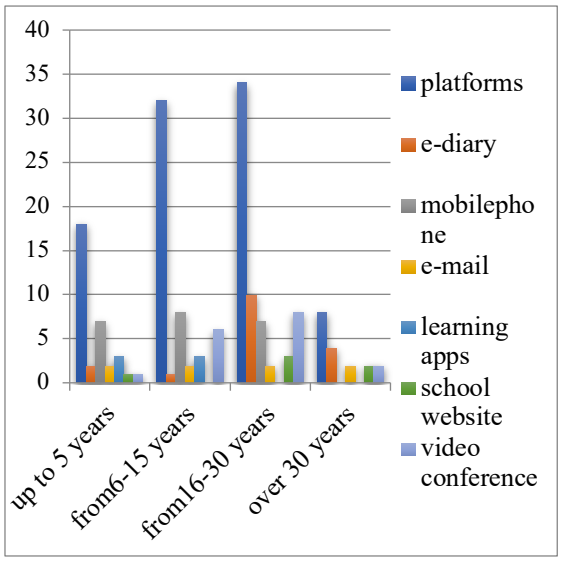
Work experience
p=0.113 χ^2=10.281 Phi=0.235 V= 0.166 C=0.229

Graph 2. Teachers' Cooperation with Internal School Organizational Bodies

The data obtained show that in relation to the survey question on conducting professional discussions within the framework of teacher meetings in various school bodies, we have the appearance of a significant statistical difference in the opinions and attitudes of teachers from schools in urban and rural areas (graph no 2). Although according to the responses obtained in both cases, positive statements prevail, the appearance of a certain degree of negative statements is not negligible, especially in schools located in rural areas. In relation to the second variable, length of work experience, we do not have the appearance of a statistically significant difference, i.e. positive statements prevail, although conducting discussions on the application of digital technologies in communication with parents is sometimes rare, which opens up new research questions in the future.

The analysis of the data from the above question on the greatest importance of digital tools for communication with parents, between the opinions of teachers from schools in urban and rural areas, a statistically significant difference appears which indicates certain differences in the valuation of digital tools (graph no 3).



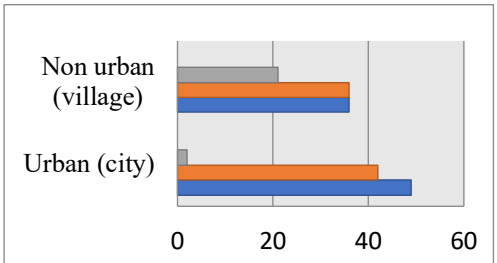


School location p= 0.017 χ^2= 15.461 Phi=.300 V=0.300 C=0.287

Work experience p=0.071 χ^2=27.440 Phi=.399 V= 0.231 C=0.371

Graph 3. The Value of Digital Technologies for Teachers Parents Communication

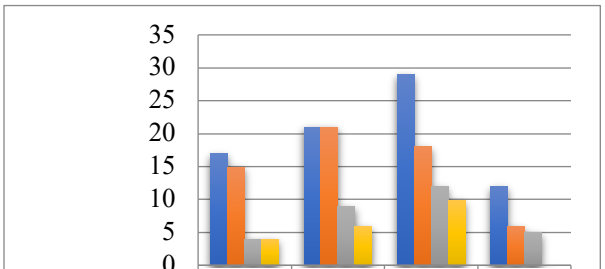
Teachers employed in schools in urban areas, unlike teachers working in rural areas, attach considerably more value to digital platforms, mobile phones, e-diary and learning apps when communicating with parents, very little to video conferences and not at all to school websites. While teachers from rural schools (unlike urban schools) also attach a greater value to digital platforms, equally to e-diary, mobile phones, e-mails, video conferences, but equally to learning apps and school websites. An interesting fact is the low value that teachers from urban school environments give to e-mail and video conferences. In terms of length of work experience (seniority), we do not see any statistically significant differences between the opinions and attitudes of teachers. It is notable that teachers with 16 to 30 years of work experience are more selective and confident, showing selectiveness according to the experience gained, or rather, they have almost no selectiveness of learning apps as a digital tool, since it is the least developed and used in education in the country.



	Urban (city)	Non urban (village)
never	0	0
sometimes	2	21
average	42	36
very	49	36

School location

p= 0.026 χ^2 = 9.294 Phi=0.224 V=0.224 C=0.218



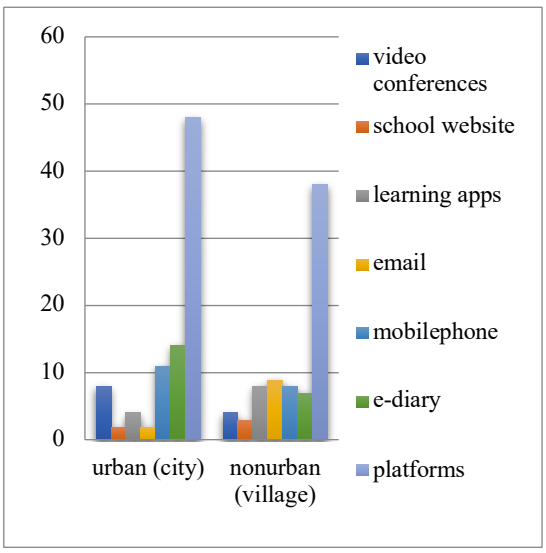
	up to 5 years	from 6-15 years	from16 -30 years	over 30 years
very	17	21	29	12
average	15	21	18	6
sometimes	4	9	12	5
never	4	6	10	0

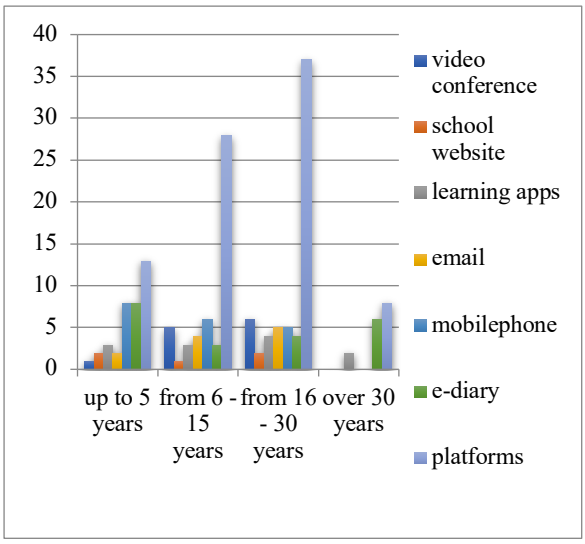
Work experience

p=0.512 χ^2=7.805 Phi=0.205 V=0.118 C=0.201

Graph 4. The Importance of Professional Support of Teachers

The data obtained from the research question aimed at having professional support for teachers when using digital technologies in communication with parents, showed that a statistically significant difference appears in the opinions and attitudes of teachers from schools in urban and rural areas (graph no 4). Namely, teachers employed in schools in urban areas, unlike teachers working in rural areas, receive greater and more frequent professional support in relation to the use of digital technologies in communication with parents. In relation to the above question considered through the variable length of teachers' work experience, we do not have the appearance of a statistically significant difference, although the dispersion of the obtained data indicates relatively frequent receipt of professional support, but also the existence of 3.72% of teachers who have never received professional support.





School location

p= 0.0106 χ^2 = 10.478 Phi=0.251 V=0.251 C=0.244

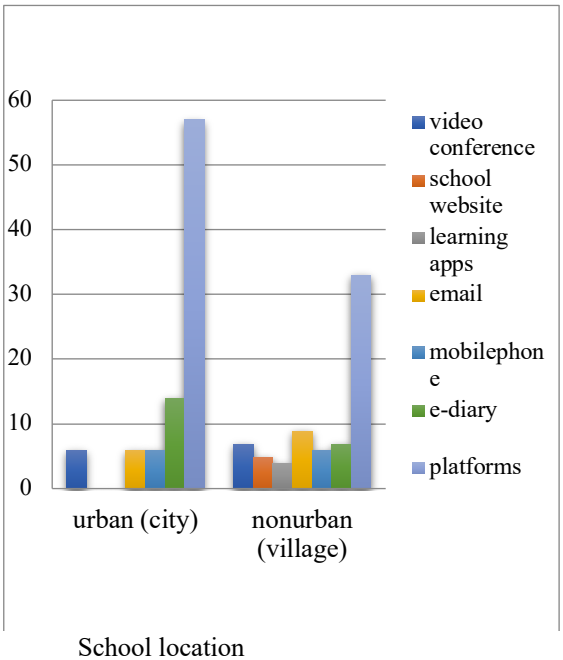
Work experience

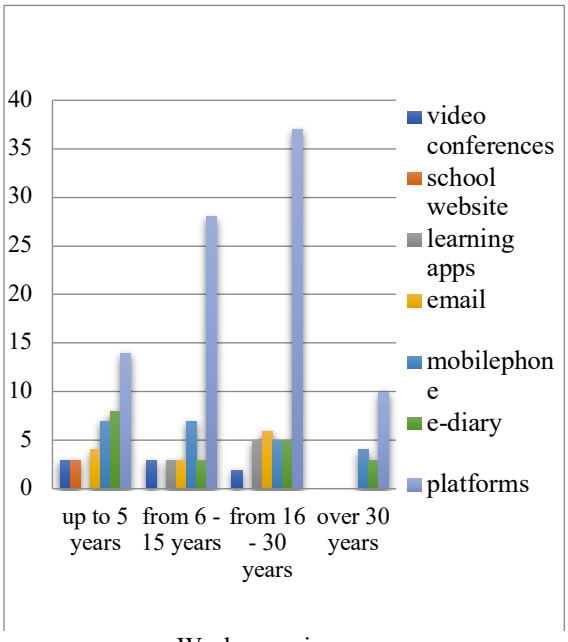
p=0.044 χ^2=29.8339 Phi=0.420 V=0.243 C=0.388

Graph 5. The Most Effective Means (tools) of Teacher Parent Communication

The analysis of the data obtained on the research question concerning the opinions and attitudes of teachers regarding the most effective digital technologies, tools for communication with parents, shows the emergence of a statistically significant difference in relation to the variable length of work experience (graph no5). In general, teachers consider digital platforms to be the most effective, followed by e-diary, mobile phones and others. What is special is the data obtained among teachers with over thirty years of work experience, who opted only for digital platforms, e-diary and learning apps, without any choice of other tools. Also, among teachers with a length of work experience of up to 5 years, in addition to the choice of digital platforms, they also consider e-diary and mobile phones to be the most effective, followed by learning apps, email, the school website and the least effective video conferencing. Among the remaining teachers, the data indicate that digital tools are fairly equally valued as the most effective, including mobile phones (teachers with six to fifteen years of work experience), video conferencing, email, e-diary and at least the school website. While among teachers with sixteen to thirty years of work experience, the order of preference indicates a more frequent preference for digital platforms, followed by video conferencing, equally mobile phones and email, then e-diary and learning apps and finally the school website.

The research question asked about the most common use of digital technology by teachers in communication with parents led to interesting data, the analysis of which showed the emergence of statistically significant differences in both variables, location of the school and length of teachers' work experience (graph no 6).





School location

p= 0.011 X^2 = 16.595 Phi=0.322 V=0.322 C=0.307

Work experience

p=0.043 X^2=33.321 Phi=0.452 V= 0.261 C=0.412

Graph 6. The most Used Digital means (tools) in Teacher-Parent Communication

Teachers employed in schools in urban areas, unlike teachers working in rural areas, in communication with parents most often use digital platforms, electronic diaries and equally use mobile phones, e-mail and video conferencing, and do not use learning apps and school websites at all. While teachers working in rural areas, in communication with parents most often use digital platforms, then e-mail, almost identically video conferencing and mobile phones, followed by e-mail, then school websites and least learning apps.

Regarding the above question, examined through the variable of teachers' length of work experience, we also have the appearance of a statistically significant difference, although the dispersion of the obtained data shows the most frequent use of digital platforms, mobile phones, e-diary and video conferencing (among teachers with five to thirty years of work experience), then learning apps (among teachers with six to thirty years of work experience), then school websites (among teachers with up to five years of work experience). The most striking are the data obtained among teachers with up to five years of work experience, who are unique in their opinion and attitudes that when communicating with parents they also use the school website, but do not use learning apps. As well as the data obtained among teachers with over thirty years of work experience, who stated that they do not use email, learning apps, the websites of the schools in which they work and video conferencing when communicating with parents.

Findings from conducting a semi-directive interview

The research includes a semi-directive interview with focus groups of thirty-five students, in order to obtain objective knowledge about certain aspects of the set research goals and research images. The teachers covered by the semi-directive interview are selected from the intended sample, from different basic areas, from urban and rural areas and with several different jobs. Their selection is carried out with their prior voluntary consent but also readiness to participate, without using basic ethical and research principles. The organization and duration of the semi-directive interview occurs more by observing the necessary parameters for implementation in approximately the same conditions for all covered focus groups, without compromising and protecting the anonymity when publishing results, integrity and the right to register the answers.

A large amount of data related to the workloads has been obtained, which will be presented in a sublimated manner, certain categories of answers and conclusions drawn. That is, some of the teachers' responses are presented in a sublimated form, which provide another angle of views and attitudes on the aforementioned issue, which are necessary for clarifying certain responses and data obtained from the application of the previous research technique - survey, but also for further research on this topic.

Specifically, one category of statements and responses related to the method of planning, implementation and evaluation of teacher-parent communication through the use of digital technology. In general, the interviewed teachers most often stated that they had certain fears and ambiguities about the success of such communication, due to their lack of continuous support and assistance, as well as about the application and selection of the most appropriate digital tool for certain, specific issues related to and arising from communication with parents.

Another category of statements and responses related to the internal organization of schools, i.e. the functioning of school authorities, bodies and other ways of organization, believing that parent councils and bodies at the level of each school should be included in communication with parents. Although they believed that there may not be a well-developed legal framework that would regulate rights, rules and responsibilities, they still believe that school management should take a more active role in creating conditions for their smooth mutual cooperation and commitment to improving communication.

Special attention was paid to the digital literacy and competence of both teachers and parents, considering (especially teachers with longer years of work experience) that younger parents do not always use digital tools appropriately and appropriately when communicating with teachers about certain "subtle" topics about their children, especially when talking to children who have a disability, or learning difficulties, or are going through a family situation, or have socio-emotional problems with peers, but also when it comes to all students in the classroom, through the use of Facebook and Instagram, but also situations where, due to being too busy, parents prefer to use digital tools that are more written and one-way, such as the example of the e-diary, messages in WhatsApp and Viber.

Teachers from schools in rural areas believe that when it comes to teacher-parent communication and digital technologies, they face certain limitations, starting from the weaker material and other capacities of schools, such as the existence of multiple branch schools of the same central school in a wider rural environment, then fewer opportunities for the inclusion of professional training and support in the field of digital technologies, as well as the overwork of parents (their daily commute to cities where they work, then household chores, etc.), as well as the migration of one or both parents to temporary work abroad.

Teachers from schools located in urban areas, in terms of teacher-parent communication and digital technologies, believed that their professional training in the aforementioned area should be available to everyone, without exception, and that the application of dissemination within the school by a trained teacher from the same school often does not result in success, partly due to difficulties in transmitting the content of the training, but also due to the preference of the teacher trainer himself, as well as the overall implementation of the training and the seriousness of the teachers involved in the training itself, due to not receiving the same certificates of importance as if they had participated directly in a non-formal training outside the school.

Discussion, Conclusion, and Suggestions

The communication of the producer within the framework of digital technologies, represents the issue that provides a wide range of aspects that are directly or indirectly, more or less related to it, contributing to the improvement of communication with access to all persons. What is clear, refers to the perceptions, expectations and beliefs of teachers towards digital technology, especially under the influence of their special competencies, professional opinion and openness to technological innovations. Undoubtedly within the framework of the above, the so-called teacher "condition" is seen from the research in relation to the preferences of teachers towards certain types of digital technologies and premises, where the length of the working faculty is an obstacle to the use of even digital opportunities that were previously known. teachers who are expected to be long in the continuity of work in education, but also the overall school environment and attitudes, preferences of student results. On the other hand, there is undoubtedly the emergence of other valuations of digital technologies depending on the length of teachers' work experience, with the youngest teachers already being more focused on newer digital opportunities, as they possess higher digital knowledge, abilities and skills, but they are more cautious about what is expected of them professionally within the schools and the education system, as well as about the reception and acceptability by parents, while teachers from the middle generation and with an average length of work experience, although they are more confident and more skilled in choosing digital technologies and tools in accordance with the goals, needs and commitments to establishing and maintaining communication with parents, are at the same time guided by knowledge and experience about the limitations, dangers, advantages and opportunities offered by digital technologies in teacher-parent communication.

The positioning of teacher-parent communication within the framework of digital technology represents a complex interdisciplinary issue, which combines broader social, educational, cultural and pedagogical aspects. Professional competencies, personal qualities, values of teachers, as well as the approach to their professional work, training and development, enable much more than just using digital technology in communication with parents, because without understanding the purpose, process and outcome of it, without research and self-exploration, without creativity and openness to innovations and new challenges, there will be no content and reason for communication with parents.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Constructivist Pedagogical Paradigm And Digital Technology In Early Childhood Learning – Conflict Or Compromise

Tatjana Koteva-Mojsovska [1] Florina Shehu [2]

Abstract

The constructivist discourse in early childhood development represents a modern theoretical pedagogical concept oriented to the child as a person who actively, authentically and contextually engages in the learning process, thereby creating his own logical and consistent constructions of knowledge. But on the other side of modern pedagogical discourses appears digital technology, which at a dizzying pace tends to penetrate all educational processes. In accordance with this challenge, the paper opens the dilemma about the need for a scientifically based complementary relationship between these two modern educational technologies. That is, this paper provides an answer of the following key research questions: 1. In which context would the application of constructivist discourse and digital technology cause a conflict in relation to the scientific assumptions of pedagogical approaches in early childhood learning and development and 2. In which context would they find themselves in a compromise relationship based on the scientific assumptions of efficient child-oriented pedagogical approaches in early childhood learning and development. In order to examine the possibilities for a complementary relationship of the two mentioned contemporary discourses, as well as the conditions in which digital technology provides educational support in constructivist learning for children, a survey and interview of experts from 6 kindergartens in the Skopje area was conducted, as well as the analysis of relevant literature and documentation. The research results in emphasizing the need to redefine and reorganize some aspects of the preschool educational process in the direction of the correct use of digital tools as a means for more efficient application of authentic and constructivist learning for children in early childhood development.

Keywords: Constructivist learning, authentic learning, early childhood development, digital technology, educational support

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Introduction

The constructivist discourse in early childhood development represents a modern theoretical pedagogical concept oriented to the child as a person who actively, authentically and contextually engages in the learning process, thereby creating his own logical and consistent constructions of knowledge. But on the other side of modern pedagogical discourses appears digital technology, which at a dizzying pace tends to penetrate all educational processes.

Constructivism represents a pedagogical orientation that emphasizes the active role of the child in the learning process, considering the moment of constructing knowledge in each child individually as significant. In contrast to traditional pedagogical models, in which knowledge is transferred from the educator to the child and in which factual learning is forced, constructivism emphasizes that knowledge is constructed through experience, interaction and reflection. In the learning process, the child is treated as a researcher, and learning is experienced as a process of creating connections between new information and acquired experiences (Piaget 1970). In this sense, the child is a constructor of knowledge who, in the focus of his learning, is gradually introduced into the learning processes and not into their products. According to the National Association for the Education of Young Children (NAEYC, 2020), the concrete manipulation of objects and social interactions are a key factor in the development of cognitive, speech and socio-emotional abilities in early childhood development.

Namely, in the first years of life, sensory experience, motor activity and symbolic play are important for children, which, according to the constructivist paradigm, are a prerequisite for cognitive development. With the help of sensory experience, the child gradually enters the phase of thinking and logical processing of experientially received information and gradually processes it, creating unique mental models and systemic knowledge about his environment. So, the constructivist pedagogical paradigm plays an essential role in early childhood education, as it emphasizes the active, exploratory and creative nature of the child. Rather than treating the child as a passive recipient of information, constructivism describes him as an active constructor of his own knowledge, which arises from interaction with the environment, problem solving and social dialogues. This approach is especially important in the earliest years, which is a period considered sensitive for cognitive, language and socio-emotional development.

Research confirms that play, manipulation of materials, and direct experience are fundamental mechanisms through which children learn and develop strategies for coping with new situations. For example, NAEYC (2020) reports that children who engage in activities that encourage critical thinking, experimentation, and interpretation of results—core components of constructivist learning—show higher levels of cognitive maturity, better language productivity, and developed self-regulation. Studies that track the learning process in natural, play-based situations (Hirsh-Pasek et al., 2015) indicate that children learn best when activities are engaging, and related to their own interests—which is fully consistent with constructivist principles. The teachings of Piaget (1970) and Vygotsky (1978), which serve as the foundation for modern constructivism, find strong support in more recent empirical research. Piaget points out that children in early childhood learn through sensorimotor experiences and the active creation of cognitive schemes, which today's neuroscience studies confirm with evidence that the brain develops most intensively when the child has the opportunity for motor and sensory interaction with the environment. On the other hand, Vygotsky emphasizes that cognitive development is linked to social interaction, and research by Edwards (2014) and other authors confirms that children who have rich opportunities for cooperative play and dialogue show progress in problem solving and the development of symbolic thinking. The need for a constructivist approach is also emphasized by the findings of the OECD (2021), which result in data that children who learn in environments that encourage autonomy, choice and experimentation develop a higher level of flexible thinking, which is the basis for success in later education. Hence, the need for constructivist-oriented learning in early childhood development is of great importance because it is closest to the natural way in which children learn, develop and create knowledge. Constructivist learning promotes play, exploration, experience, and interaction with the physical and social environment, which places the child in the role of an active constructor of knowledge. Therefore, the discussion of how digital technology fits into this paradigm is a key issue for contemporary pedagogy.

Accordingly, the question arises: How can technology be a tool for the benefit of children's active, authentic, constructive learning, and not its opponent? Namely, this question imposes many dilemmas and different answers such as: Does the introduction of digital technology in early childhood education violate the concept of constructivist pedagogy and does the child become passive in the learning process, does his movement in real contexts decrease, does his active and authentic learning become impossible, etc. There is also a great dilemma regarding the survival of the child's social and interactive contacts in the environment. Regarding these dilemmas, research shows that digital tools offer new constructivist opportunities for expression, creation, communication and critical thinking if they are used in contexts where the child has freedom of choice, meaningful involvement and the opportunity to create artifacts related to his own experience (Papert, 1980; Arnott, 2016; Hatzigianni, 2018). In such conditions, digital technology becomes a medium through which the child constructs knowledge, rather than just consuming information. In fact, the problem is not in the use of digital technology, but in the way it is used and in the readiness of educators to use it in scientifically based educational practice, i.e. in child-oriented practice

In constructivist-oriented digital early learning, the teacher has a key role. He manages and balances the process of constructivist learning with the use of digital technology, i.e. provides a balance between digital and analog activities in educational work, models the way technology is used, creates situations for collaborative research, monitors how digital technology affects cognitive, social and emotional development, etc.

In accordance with this challenge, the paper opens the dilemma about the need for a scientifically based complementary relationship between these two modern educational technologies

Method

The purpose of this research is: To examine the possibilities for a complementary relationship of the two mentioned contemporary discourses (constructivist discourse and digital technology), as well as the conditions in which digital technology provides educational support in constructivist learning for children. To realize this goal, we set the following Key Questions:

1. In which context would the application of constructivist discourse and digital technology cause a conflict in relation to the scientific assumptions of pedagogical approaches in early childhood learning and development?

2. In which context would they find themselves in a compromise relationship based on the scientific assumptions of efficient child-oriented pedagogical approaches in early childhood learning and development?

3. Do we have the conditions and do teachers feel prepared for the safe use of AI in the learning of children in preschool education?

The research has a quantitative and qualitative character and the analytical-synthetic, comparative and descriptive method was used. As a research instruments we conducted a survey of 33 preschool teachers in Skopje, RNM and Interviewed 56 educators distributed in 10 focus groups. The questionnaire contained 24 open-ended and closed-ended questions that examined the opinion of educators on the possibility of using digital tools without disrupting the constructivist approach to learning and development of children in early childhood education. The questionnaire was implemented via the Google form and a total of 33 respondents responded to it. However, on the other hand, it is interesting that for each question from the questionnaire we received a maximum of 31 responses, which made the interpretation of the results a little more difficult. Statistical processing was carried out through the same platform. The interview was structured, conducted in 10 focus groups in which a total of 56 teachers participated. The answers from the interview were qualitatively processed and supplemented the answers obtained with the questionnaire.

Results, Analysis and Discussion

The research results in emphasizing the need to redefine and reorganize some aspects of the preschool educational process in the direction of the correct use of digital tools as a means for more efficient application of authentic and constructivist learning for children in early childhood development. In the

interest of the given parametars for this paper, the data analysis is based on representative responses (not on all questons of the questionare) that provide a complete picture of the problem we investigated.

On the question regarding the frequency of using digital tools in the planning or in the activities with children 32% of all respondents stated that they use digital tools very often. Of the total number of respondents, 29% use them often and again 29% use them sometimes. This indicates that digital technology is used to a sufficient extent, but not constantly, in preschool education within the surveyed kindergartens. The remaining answers to this question refer in 3.2% of cases to the answer "never" and 6.5% to the answer "constantly." Contrary to the answers from the questionnaire, in the interview regarding this question, the respondents reported insufficient use of digital technology in early childhood education and emphasized the existence of enthusiastic steps in this field but without support - without guidance and coordination from a higher level.

Due to the frequent use of digital technology shown in the questionnaire, we were interested in how familiar educators are with the constructivist approach to learning in early childhood development. This question had five possible answers, of which 40% of the respondents gave the answer referring to a good knowledge of this approach. 16.7% of the respondents knew the constructivist approach quite well, while 26.7% of the total number of respondents were partially familiar with it. Considering the percentages of the answers “good” and “fairly good” knowledge of this approach to learning in early childhood education, the idea arose that the frequent use of digital technology should be well balanced with the scientific assumptions in the application of the discourse of constructivist pedagogy in preschool practice. However, these answers are still not sufficient for this assumption to be drawn as a conclusion in relation to the research objective.

In accordance with this finding, we were interested in how much educators are trained to use digital technologies in accordance with the scientific premises of the constructivist paradigm in early childhood education. The answers to this question were almost equally distributed across the key answers offered. Namely, 22.6% of the total number have insufficient training, an identical percentage (22.6%) stated that they have sufficient training, while 29% consider themselves to have solid training. Only 6.5% stated that they have excellent, more extensive training, while the remaining percentages of respondents answered that they are not trained or chose the answer that refers to something "other". The answers distributed in this way produce an assumption that the use of digital tools may not be adapted to the constructivist discourse in early childhood education.

To the question: “In your opinion, can digital technology be aligned with the constructivist pedagogical approach in preschool education?” none of the answers significantly dominates. 16.1% of the total number of respondents opted for full alignment. The largest number, 35.5% of them, believe that this can be done only in certain situations, while 29% of them believe that there can only be partial alignment. The focus group interviews, in each group separately, confirmed the view of the majority of the interviewed participants that full alignment between digital technology and the constructivist pedagogical approach, at least for now, cannot exist. According to them, such a thing requires full readiness of the educational staff for both discourses, as well as greater practice during the initial education of educators.

In accordance with the above, we were interested in what challenges (conflicts) respondents observed when integrating digital technologies with the constructivist approach in preschool practice. This question offered the possibility of selecting multiple answers from the following offered: Insufficient technical resources, Insufficient digital literacy, screen overload, Inappropriate content, Lack of educational software, Limited interaction with real content, Lack of strategies for ending addiction to digital tools. Despite the possibility of selecting multiple answers, the percentages represented in each individual answer are small and range from 6.7% for the answer "inappropriate content" to 26.7% for the answer "lack of educational software". The interview, regarding the conflicts and obstacles for digital technology to be aligned with the constructivist paradigm, showed that the main conflicts here would be the insufficient digital literacy and the lack of educational software that should be used in the processes of upbringing and education with children in early childhood development. Namely, the respondents appreciate that the introduction of digital technology as well as artificial intelligence has a

faster penetration in preschool education than the preparation of personnel and changes in their education and in the program and organizational structure of preschool education in our country.

The following alternative answers were given to the question regarding the compromises that educators undertake to reconcile the two aforementioned discourses in working with children: Interactive applications for research, Combining digital content with play, Discussing content from digital tools, Creating and solving problem tasks, and Other. The highest frequency of responses, i.e. 41.9% of the total, was distributed to the alternative "Combining digital content with play", while 25.8% of the respondents believe that the compromise would be found in the conversation about certain content of the digital tools. The interview here showed that if there were educational software, children, each separately, would focus on research, analysis, connection and creation of knowledge and the like, i.e. on activities that represent attributes of constructivism in learning. The respondents, regarding the possibility of ensuring a complementary (supplementary) relationship between the use of digital technology and the application of constructivist discourse in children's learning in early development, in the majority, 32.3% of the total number have no specific opinion, 12.0% of them do not believe that it is possible, 16.1% consider it impossible. According to 22.6% of the respondents, the complementary relationship between digital technology and constructivist discourse is partially possible, and according to 16.1% it is completely possible.

Such responses are understandable given the fact that a very small percentage of respondents (23.3% of the total number), on a scale from 1-lowest to 5-highest, rate themselves at the highest level (5) in terms of readiness to ensure a complementary relationship between the two examined discourses. The highest percentage (33.3% of the responses) in terms of the assessment scale is found at grade 3 (medium level), which is not enough to provide conditions for a complementary relationship between the observed discourses. The focus group interview also showed insufficient readiness of the respondents in terms of this issue.

Regarding the proposals that the respondents gave as a basis for establishing the alignment of digital technology with the nature of the child's learning in early childhood development, the proposals that relate to the following are interesting: Increasing the number of educational staff in kindergartens; Providing better material conditions; Changes in the program structure of early childhood education; Redefining standards and educational goals; Development of a guide for the application of digital tools; Education of staff; Development of software for educational games and activities with children, etc.

Conclusions and Suggestions

The analysis of the results provided interesting conclusions, including:

- Preschool teachers appreciate that in order to use digital tools in function of constructivist pedagogical approaches, there is a need to change the program, redefine the goals and to develop guidelines for the use of AI technology in the educational process with the youngest.
- Teachers do not believe that a balance can be achieved between the application of the scientific constructivist paradigm for active and natural learning and the application of AI in learning. According to them, the latter (second one) devalues the former (first one).
- By the time of the research, the respondents stated that they had not received any guidance regarding the constructive use of either IT technology or AI in children's learning in the period of early childhood development
- Teachers do not have enough program content and guidelines with which they can organize and combine constructive with digital activities in a targeted manner
- The use of digital tools in learning prevents the involvement of the senses, which is especially important for authentic learning through experience
- Educators see the introduction of digital technology in the implementation of constructivist learning as a conflict situation and an obstacle to successful pedagogical activity but within the framework of the current conditions.

Key points

- Digital technology can be a potential threat to children's play and creativity if it is not pedagogically organized and constructivist-oriented (key question 1)
- In order to function in the constructivist pedagogical approach, digital tools should be used by children to document experience, to create and share knowledge, to discuss about some digital contents etc. In this way, children are in the role of participants and not just users (key question 2)
- There are not enough original conditions and educators do not feel ready to use digital tools in the constructivist pedagogical approach. Specific training is needed for this purpose (key question 3)

With the help of proper pedagogical design, the digital technology becomes an ally in the creation of authentic children's experiences and knowledge.

Significant authors' view (suggestion)

It would be good to introduce a separate study subject in the initial education of preschool teachers, the so-called digital pedagogy, or a modularly set topic in some of the study subjects that would focus on the use of digital tools in order to respect the individuality of children, their needs, and personal experiences and creations.

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Pre-Service Teachers' Interactions with a GenAI Tool: Exploring TPACK in Science Lesson Planning

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Abstract

This study explored how pre-service elementary teachers engaged with a GenAI tool during science lesson planning and how their Technological Pedagogical Content Knowledge (TPACK) was reflected in this process. The context was a three-hour session within a University course, where 21 pre-service teachers were asked to design a Grade 5 science lesson on "Heat and Temperature" using the free version of ChatGPT. We analysed full prompt-response logs with ChatGPT as well as the final lesson plans that participants produced afterwards. Prompts were first coded deductively using TPACK domains and then analysed inductively to identify themes in interaction patterns. We examined the lesson plans using qualitative content analysis, focusing on nine aspects of instructional quality and technology use. Our TPACK coding showed that pre-service teachers mostly turned to GenAI for help with content and pedagogy, while technology-related domains appeared much less often. When we looked more closely at the prompt–response pairs, we found that all participants used ChatGPT to think through pedagogical choices and ways of bringing in technology, and many of them also evaluated and modified its suggestions. In the final lesson plans, most designs included clear objectives, student-centred activities tied to everyday experiences, a coherent lesson flow, and, in many cases, purposeful use of the available technology. However, some plans either omitted technology or used it mainly for presentation, and differentiation for diverse learners was only weakly addressed. Overall, the findings depicted a partial enactment of TPACK in a GenAI-supported planning task and highlight the need for explicit scaffolding of technology-related domains and critical GenAI literacy in teacher education programmes.

Keywords: GenAI, TPACK, Lesson planning, Teacher education.

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Introduction

In recent years, generative AI (GenAI) tools have moved rapidly from experimental systems to everyday use in education. One prominent example is ChatGPT, which is based on large language models (LLMs). Because these tools can quickly produce text, explanations, examples, and suggested tasks, they have become a regular topic of discussion about how education - and teachers' work in particular - may change as GenAI becomes more widespread (Albadarin et al., 2024; Grassini, 2023; Trust et al., 2023; Yang (杨晓哲) et al., 2024). Some authors emphasize the potential of GenAI to ease many of the most labor-intensive aspects of teaching, such as preparing resources, giving feedback, or designing assessments. At the same time, others stress problems such as biased and opaque outputs, hallucinations, threats to academic integrity, and the risk that teachers come to rely too heavily on automated suggestions (Giannakos et al., 2025; Maita et al., 2024; Mishra et al., 2023; Zhang & Tur, 2024). In response, international policy guidelines call for human-centred and ethical uses of GenAI in education and make it clear that these tools are meant to support, not replace, teachers' expertise (UNESCO, 2023).

For many teachers, lesson planning seems to be one of the first places where GenAI enters their everyday practice. Planning a lesson means making judgements about curriculum aims, the order and type of activities, assessment, and how to respond to students' difficulties. In science education, this work is particularly demanding because teachers are expected to support inquiry, work with data and representations, and help pupils relate abstract ideas such as heat and temperature to familiar situations, often with the help of digital technologies (Wang et al., 2010; Webb, 2005). As GenAI tools become more accessible, it is plausible that novice science teachers will first experiment with these systems in the context of lesson planning.

To examine the role of GenAI in teachers' lesson planning, this study used the Technological Pedagogical Content Knowledge (TPACK) framework as its main analytical lens. TPACK was employed to describe how teachers bring together technological, pedagogical, and content-related considerations when they design and justify technology-enhanced lessons (Mishra & Koehler, 2006). Building on recent discussions of GenAI and TPACK, we used this framework as a practical tool for analysing the decisions teachers make when they involve GenAI in their lesson planning (Mishra et al., 2023).

In this context, the present study examined how pre-service elementary teachers worked with a GenAI tool while designing a Grade 5 science lesson on "Heat and Temperature". Using TPACK as our analytical framework, we analysed their prompt - response interactions with the free version of ChatGPT and the lesson plans that emerged from this co-design process. Specifically, we addressed the following research questions: (1) which TPACK domains are most frequently represented in the prompts that pre-service teachers address to GenAI, (2) what kinds of patterns characterise their interactions with the tool, and (3) how pedagogical, content-related, and technological elements are integrated into the final lesson plans. In doing so, the study offers a process-focused view of GenAI-supported science lesson planning in initial teacher education.

Literature Review

In educational literature, GenAI is discussed both as a support for content creation, feedback, and assessment and as a source of concerns related to bias, opacity, hallucinations, and overreliance (Giannakos et al., 2025; Mishra et al., 2023). Specifically for teachers, GenAI tools are expected to affect everyday practice by assisting - rather than replacing - teachers in preparing instructional material, adapting instruction to student needs, providing feedback, or assessing student work (Hashem et al., 2024; Moundridou et al., 2024; van den Berg & du Plessis, 2023). Hence, it is important to understand what types of professional knowledge are required by teachers to engage with GenAI tools in a manner that preserves teacher agency and professional responsibility.

Lesson planning is widely recognized as a core element of teachers' professional competence, as it requires them to set learning objectives, select and sequence activities, plan assessments, and align instruction with learners' needs. Consequently, written lesson plans play a central role in teacher education and certification, especially in science (Großmann & Krüger, 2024). In this context, recent empirical studies have begun to examine how pre-service and in-service teachers use GenAI tools such

as ChatGPT to brainstorm ideas, differentiate tasks, and generate lesson plans in both science and other domains (Choi, 2025; Luo & Tahir, 2025; Şimşek, 2025; Sun & Huang, 2025; Yorulmaz et al., 2025). Finally, there is strong agreement that GenAI should support rather than substitute teachers' professional judgement (Peikos & Stavrou, 2025; van den Berg & du Plessis, 2023).

To conceptualize how teachers design and evaluate such GenAI-assisted science lessons, this paper draws on the TPACK framework. TPACK extends Shulman's (1986) notion of pedagogical content knowledge by emphasizing how technological, pedagogical, and content knowledge (TK, PK, and CK) and their intersections (PCK, TCK, TPK, and TPACK) are interwoven in technology-enhanced teaching (Mishra & Koehler, 2006). In science education, digital technologies can support inquiry, provide access to authentic data, and offer multiple representations that help students connect school science with everyday experiences, while also scaffolding cognitive acceleration, self-management, and formative assessment (Wang et al., 2010; Webb, 2005). In this regard, TPACK has become an important framework for describing how science teachers orchestrate disciplinary ideas, inquiry-oriented pedagogies, and technological tools. Within research on TPACK in science education, written lesson plans and related planning or reflection discourses are used as artefacts to examine pre-service teachers situated or enacted TPACK (Canbazoglu Bilici et al., 2016; Ga et al., 2025; Harris & Hofer, 2011; Stinken-Rösner et al., 2023). Moreover, recent conceptual work argues that TPACK remains highly relevant in the "age of GenAI", describing GenAI as "protean, opaque, unstable, generative and social" and proposing TPACK as an analytical lens for understanding the knowledge teachers need to use GenAI critically and responsibly (Mishra et al., 2023). In line with this view, Wen and Wen (2024) used TPACK to analyze how pre-service teachers designed unit plans with ChatGPT in a teacher education course, showing how they leveraged and respond to GenAI during instructional design processes. Recent research further showed that ChatGPT can serve as a resource for generating and refining unit plans (Wen & Wen, 2024) or lesson ideas (Lee & Zhai, 2024), and that GenAI-enabled lesson plans can be evaluated using TPACK-based rubrics (Lee & Zhai, 2024). Other work uses PCK-based content analysis to examine the characteristics of ChatGPT-generated science lesson plans and highlights the importance of PCK-informed prompts and critical evaluation of AI outputs (Peikos & Stavrou, 2025). This body of work also underscores the need for more process-oriented research on how educators integrate technological, pedagogical, and content knowledge as they interact with GenAI tools while designing instruction, and how they respond to and adapt AI-generated outputs (Mishra et al., 2023; Wen & Wen, 2024).

Against this background, the present study focused on pre-service elementary teachers' use of a GenAI tool during science lesson planning, addressing the need for more process-oriented research on how TPACK is enacted in GenAI-supported design.

Method

Research Model

This study adopted a qualitative research design. The focus was on understanding how TPACK emerges as pre-service teachers co-design a science lesson with the free version of ChatGPT, through in-depth analysis of their interaction logs and final lesson plans.

Study Group

Twenty-one pre-service teachers (PSTs) in their final semester of a department of primary education participated in the study. All were enrolled in an elective course on digital technologies in science education in which they had been introduced earlier in the semester to the basic principles of the TPACK framework. Throughout their studies, they had been required to design lesson plans in several courses and had gained initial instructional experience in real classroom settings through their practicum.

Procedure and Data Collection Tools

The study was conducted in May 2025 during a single three-hour class session. At the beginning of the session, students were informed about the purpose of the study and the procedures that would be followed. They were explicitly informed that no personally identifying information would be collected, that their data would be treated confidentially and used only for research purposes, and that participation

was entirely voluntary. Students were assured that their decision to participate or not would have no impact on their course grades and that they could discontinue their participation at any point. No incentives were offered for participation. Those who agreed to participate provided written informed consent.

Before starting their interaction with the free version of ChatGPT, participants completed a short demographic questionnaire including age and gender. They were then asked to complete a brief survey on their prior experience with GenAI tools (e.g., ChatGPT, DeepSeek, Copilot, Gemini, Claude AI, DALL·E, Suno). This survey included: (a) a Likert-scale item on how often they had used such tools in the past (1 = Never, 2 = Once or twice, 3 = Several times, 4 = Very often); (b) for those who reported prior use, an open-ended question asking them to indicate the purposes for which they had used GenAI tools (e.g., completing assignments, creating educational materials, entertainment, searching for information); (c) a question on whether they held a paid subscription to any GenAI tool; and (d) a Likert-scale item on how familiar they considered themselves with GenAI tools (1 = None, 2 = Low, 3 = Moderate, 4 = High, 5 = Very high).

Then, participants were provided with a written scenario describing a typical Grade 5 classroom in a Greek primary school. They were asked to assume the role of the classroom teacher responsible for 25 students with diverse learning abilities. The scenario specified that the classroom was equipped with an interactive whiteboard and that the school had five laptops available for instructional use. On this basis, participants were asked to design a lesson plan for the Grade 5 science unit “Heat and Temperature”. Participants were informed that the lesson plan should include clearly articulated learning objectives and detailed descriptions of appropriate learning activities, adequately describe the teaching techniques to be employed and the materials to be used, and, where pedagogically appropriate, make use of the available digital technologies.

Following the presentation of the scenario and task requirements, participants interacted with the free version of ChatGPT to develop their lesson plans. They engaged in an iterative dialogue with the tool, using its suggestions to develop and refine their instructional design. Once they had completed their plans, participants submitted two separate documents: one containing the full ChatGPT interaction log and one containing the final lesson plan.

After submitting their documents, participants completed a short post-interaction questionnaire. They responded to three open-ended questions: (1) how ChatGPT had contributed to their pedagogical decisions during lesson design (e.g., defining learning objectives, selecting teaching techniques, choosing activities and materials, integrating technology); (2) whether they felt they or ChatGPT had controlled the lesson planning process, and why; and (3) whether they would use a GenAI tool such as ChatGPT for lesson planning in the future, and if so, how (or, if not, why not). Finally, they answered a Likert-scale item on the extent to which the interaction with ChatGPT had helped them develop their pedagogical thinking (1 = Not at all, 2 = A little, 3 = Moderately, 4 = Much, 5 = Very much). All questionnaires and document submissions were administered and collected online using the LimeSurvey platform.

Data Analysis

Participants’ interaction logs with ChatGPT were analysed in two stages. First, all PSTs’ prompts were extracted and coded deductively using the TPACK framework (i.e., CK, PK, TK, PCK, TCK, TPK, TPACK). Each prompt was assigned to one or more knowledge domains based on its primary focus, and code frequencies were summarised across participants to identify which aspects of TPACK were most and least frequently represented. Second, the full prompt-response pairs were analysed inductively through iterative open coding. Recurring patterns of interaction were grouped into broader themes, such as pedagogical reasoning and instructional planning, technology integration, role perception and control, emotional and motivational language, and meta-reflective prompts.

Participants’ final lesson plans were analysed using qualitative content analysis to investigate how pedagogical, content-related, and technological elements were integrated into the final outputs. To this end, each lesson plan was coded against nine dimensions: clarity of instructional goals, presence of student-centred activities, instructional techniques and strategies, assessment methods, alignment

between assessment and goals, meaningful integration of digital technology, attention to differentiation and student needs, authenticity of activities, and overall lesson coherence and flow. These dimensions were derived from the task guidelines provided to participants and from established criteria for high-quality, technology-enhanced lesson planning from a TPACK perspective.

We used the pre-interaction demographic questionnaire and the post-interaction reflection questions only to contextualise the sample and to understand participants' previous experience and views of GenAI and did not analyse these data systematically in this paper.

Findings

Deductive Analysis of PSTs' prompts

In total, 244 prompts were produced by the 21 PSTs. Forty-five prompts were excluded from the analysis because they included greetings, single-word acknowledgements, or generic conversational turns (e.g., "Good morning", "yes", "okay", "thank you", "I need your help with something"). The remaining 199 prompts could be assigned to more than one TPACK domain, resulting in 542 individual codes in total. Table 1 summarises the distribution of TPACK codes across all prompts.

Table 1.
Frequency of TPACK codes in PSTs' prompts (N = 542 codes)

TPACK Domain	Frequency
CK	129
PK	176
PCK	121
TK	46
TCK	18
TPK	31
TPACK	21

Pedagogical Knowledge (PK) and Content Knowledge (CK) were the domains that appeared most frequently, often in combination as Pedagogical Content Knowledge (PCK). This result suggests that PSTs mainly asked ChatGPT to help them clarify and understand the content, organise the lesson, and formulate instructional activities. In contrast, Technological Knowledge (TK) and the technology-related domains (TCK, TPK, TPACK) appeared less often, indicating that participants did not explicitly try to connect the available technological tools with specific content goals and pedagogical strategies.

Inductive Analysis of Prompt-Response Pairs

The inductive analysis of prompt-response interactions revealed five major themes in how PSTs engaged with ChatGPT during the task of lesson planning: (a) pedagogical reasoning and instructional planning, (b) technology integration, (c) role perception and control, (d) meta-reflective prompts, and (e) emotional and motivational language. An overview of these themes and the number of PSTs whose interactions included each theme is presented in Table 2.

Table 2.
Themes from prompt-response interactions (N=21)

Theme	Brief description	Prompt Examples	Number of PSTs (n)
Pedagogical reasoning & instructional planning	Prompts asking for help with lesson structure, introductory activities, identifying prior ideas, sequencing teaching steps.	"intro activities to spark curiosity and elicit prior ideas", "how to continue given these objectives"	21

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Technology integration	Prompts about using the interactive whiteboard, laptops, simulations or videos within the lesson.	"how could I use the interactive whiteboard here?"	21
Role perception & control	Prompts that evaluate, constrain, or redirect ChatGPT's suggestions; teacher positioning as decision-maker.	"I used only the activities I considered appropriate for my class"	19
Meta-reflective prompts	Requests to check coherence, suitability or alignment of the emerging lesson design.	"Include a gas example, not only solids/liquids"	16
Emotional & motivational language	Expressions of appreciation, relief, or enthusiasm towards the ChatGPT for the ideas produced.	"This is very interesting, thank you"	9

Overall, all 21 PSTs used ChatGPT to help them structure the content, flow, and activities of their lessons, and each participant also engaged in prompts about how to incorporate the available digital tools into their plans, reflecting the themes of pedagogical reasoning and instructional planning and technology integration. Role perception and control and meta-reflective prompts appeared in most cases (19 and 16 PSTs respectively), indicating that many PSTs evaluated ChatGPT's suggestions, and sought to retain control over the co-design process. Emotional and motivational language was present in a smaller subset of interactions (9 PSTs) and typically accompanied moments of appreciation or enthusiasm during the co-design task.

Content Analysis of Final Lesson Plans

The content analysis of the 21 final lesson plans examined how pedagogical, content-related and technological elements were integrated in the PSTs' lesson designs across nine dimensions. Each plan was coded on a three-level scale (strong / clearly present, partially present, limited / absent). The overall distribution is shown in Table 3.

Table 3.
Summary of lesson plans across analytic dimensions (N = 21)

Dimension	Strong / Clearly present (n)	Partially present (n)	Limited / absent (n)
Clear instructional goals	18	3	0
Student-centred activities	20	1	0
Instructional techniques / strategies	20	0	1
Assessment methods	15	6	0
Assessment-goals alignment	9	11	1
Meaningful integration of digital technology	15	2	4
Differentiation / student needs	5	1	15
Authenticity of activities	19	2	0
Lesson coherence and flow	19	2	0

The analysis suggests that in almost all lesson plans, both instructional goals and instructional techniques were explicitly defined. PSTs selected student-centred activities that linked the topic of "Heat and Temperature" to pupils' everyday experiences (e.g., body temperature, weather, household contexts) and generally followed a clear introduction - development - assessment flow. Assessment methods were present in all lesson plans, although explicit alignment between assessment tasks and the stated lesson objectives was not always evident. Regarding the meaningful integration of digital technology, the majority of lesson plans made instructionally purposeful use of the available tools, for example by incorporating the interactive whiteboard or laptops into student activities in ways that supported conceptual understanding. However, in six plans, the use of technology was limited or absent, or remained largely presentational (e.g., showing a video). The least developed dimension was differentiation and student needs, as only five lesson plans provided strong evidence of explicit strategies for supporting diverse learners (e.g., adapted tasks, additional scaffolding).

Discussion, Conclusion, and Suggestions

The findings from the TPACK-based deductive analysis of PSTs' prompts reveal that pre-service teachers asked ChatGPT mainly for assistance with content and pedagogical knowledge rather than with technology-related issues, as the most frequent domains were PK and CK, often combined as PCK. More specifically, participants primarily turned to ChatGPT to clarify scientific ideas, structure the lesson, and generate activities, rather than to explore how specific technologies could support the "Heat and Temperature" content or instructional decisions. This result is consistent with earlier work on pre-service science teachers' lesson planning, which has documented a strong emphasis on content and pedagogy and relatively superficial uses of technology (Janssen et al., 2019; Janssen & Lazonder, 2016).

The inductive analysis of prompt-response interactions showed that PSTs assessed ChatGPT's output and engaged in pedagogical reasoning and technology integration prompts. Moreover, many participants used role perception and meta-reflective prompts to evaluate or revise the tool's suggestions. This finding is in line with recent studies suggesting that teachers consider GenAI tools as a source of ideas to be adapted rather than a replacement for their own professional judgement (Gurl et al., 2025; Kalenda et al., 2025; Lee & Zhai, 2024; Wen & Wen, 2024).

The analysis of PSTs' final lesson plans showed that most outputs included clear learning objectives, student-centred activities connected to pupils' everyday experiences and followed a coherent introduction-development-assessment structure. Furthermore, many of the plans made meaningful use of the available technological tools. However, a subset of PSTs either did not include any technology or designed lessons in which digital tools were used mainly for presentational purposes. The weakest dimension across plans was differentiation and attention to student needs, with relatively few PSTs specifying explicit strategies for supporting diverse learners. This pattern supports the view in GenAI-focused teacher education that, without explicit attention to equity and learner diversity, such tools are likely to reinforce one-size-fits-all lesson designs (Celik et al., 2026; Kalenda et al., 2025).

Considering these results, we see three main implications for integrating GenAI into teacher education and professional development programmes in ways that support TPACK development. First, the strong emphasis on CK, PK, and PCK in both prompts and lesson plans suggests that training programmes need to provide more explicit support around TCK, TPK, and TPACK, treating GenAI prompting as a pedagogical skill that teachers must learn to use purposefully (Park & Choo, 2025). Second, the presence of role perception and meta-reflective prompts indicates a productive starting point for fostering critical GenAI literacy. Teacher educators can build on this by asking pre-service teachers to systematically evaluate, compare, and revise AI-generated ideas against research-informed criteria for high-quality, technology-enhanced lessons (Großmann & Krüger, 2024; Gurl et al., 2025; Wen & Wen, 2024). Third, the limited attention to differentiation in the final plans shows that learner diversity, equity, and inclusion need to remain central in how GenAI is used for lesson planning. Overall, these points suggest that GenAI should be framed in teacher education as a tool for practising and making visible TPACK, and not as an automatic lesson-planning engine (Giannakos et al., 2025; UNESCO, 2023).

This study has several limitations. The sample was small and focused on one science topic ("Heat and Temperature") within a single three-hour session. Therefore, the findings are context-bound and not generalisable. Furthermore, we analysed planning processes and written lesson plans only, without

examining how these GenAI-supported designs were implemented in classroom or how they influenced student learning. Future research might follow teachers over time or compare different scaffolding approaches in various subjects and settings, to see how these experiences influence their GenAI use and TPACK, and how GenAI-supported planning links to classroom practice and student outcomes. Despite these limitations, the study gives a process-focused view of how TPACK shows up as pre-service teachers use a GenAI tool for science lesson planning and offers empirical insight into the opportunities and challenges of introducing GenAI into teacher education.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Creating Textbooks for the New Generation of Students: Structure, Content and Function

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Abstract

Modern education sets high standards in the implementation of educational activity. In this context, the modern textbook has an irreplaceable role in the implementation of quality educational processes. Given the changes in the way of learning, the development of digital literacy and critical thinking among students, there is a need to create a new type of textbooks - functional, methodically oriented and pedagogically based. Today, the textbook is not only a source of information, but also a means of stimulating the student's activity, independent thinking and acquisition of functional knowledge. For the successful realization of the function of the textbook, its structure, i.e. the adequate composition of the elements of the structure, is of exceptional importance. The quality of the textbook also depends on the manner of presenting the teaching content. Specifically, this implies a manner of presentation that will enable easy memorization of facts, understanding of concepts, laws, rules, definitions and encouraging logical and critical thinking.

This paper examines the significance of the structure and content of the textbook as factors that influence the quality of education. It investigates how the manner of grouping the content, the visual and textual organization, the clarity of the objectives and the didactic-methodical apparatus influence the learning process. Special emphasis is placed on the functionality of the textbook: whether and how successfully it activates the cognitive and affective capacities of the students, whether it encourages the development of skills, understanding and argumentation, and whether it adapts to their needs and interests.

The research indicates that textbooks should be freed from the template and reproductive presentation of the material, and instead offer a clear structure, interactive content and an incentive for thinking. Creating textbooks for the new generation of students means integrating didactic-methodical logic with modern pedagogical trends, in order to create conditions for quality and lasting knowledge.

Keywords: textbooks, fucanctional knowledge, structure, content, function, didactic-methodical apparat

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Introduction

Modern education systems are in a period of intense transformations caused by digitalization, globalization and new ways of cognitive and social functioning of students. This leads to the need to redefine the concept of the textbook as a traditional teaching resource. This paper aims to analyze the structure, content and function of the modern textbook, emphasizing the need to integrate interactive, multimodal and competency-based practices. Textbooks are a basic pedagogical tool in formal education and are traditionally considered the main bearer of knowledge. The analysis indicates that the new generation textbook should be a dynamic pedagogical tool that encourages the active role of the student in the learning process. Social and technological changes in recent decades have created a generation of students who learn differently – visually, interactively, critically and through digital media. Therefore, the modern textbook must reflect this new paradigm of learning. Changes in curricula, the need for functional competencies and the orientation towards active learning require redesigning textbooks towards greater dynamism, adaptability and multimodality

Results of the Conducted Research

For the purposes of this paper, and in order to understand the attitudes of teachers regarding the textbooks they use in primary education, we conducted a survey of 100 teachers electronically. The survey contained ten questions, but in order not to burden the paper with graphic displays from the processing of the results and in addition to respecting the propositions, we will present them narratively.

On the first question, which referred to expressing agreement with the view that a quality textbook is the key to the success of educational work, we obtained the following results: 75.92% of teachers agree with this view, 18% disagree, and 22.22% partially agree with this view. When asked whether textbooks used in primary education contribute to encouraging activity and developing students on a cognitive and affective level in the process of acquiring knowledge, skills, habits, abilities, etc., most teachers (67.27%) believe that this is only partially achieved, while 25.45% responded that they do not see such an opportunity in the existing textbooks. and only 7% responded positively. Furthermore, 60% of the teachers believe that the textbooks they work with are partially attractive in terms of perceptual, intellectual and emotional aspects, 18.18% believe that the textbooks are not attractive and only 1.82% responded positively regarding the attractiveness of the textbooks. The next two questions related to the structure of the textbooks. In this context, 60% of the surveyed teachers believe that the textbooks in primary education partially have a good structure, i.e. the elements of the structure are adequately composed, 34.55% stated that the textbooks do not have a good structure and only 5.45% rated the structure of the textbooks positively. The next question, which asked for specific structural elements missing from the textbooks, stated that 70.91% of the surveyed teachers stated that elements that are in the function of content acquisition and efficient active learning (didactic and methodological equipment, questions, tasks, exercises) are missing, according to 10.91% of the teachers, elements that are in the function of presenting the content are missing, and according to 18.18% - elements that are in the function of easy finding and orientation in working with the textbook.

Since one of the key issues in assessing the quality of a textbook is the amount of information that it offers to students, the next question was in that direction. It is interesting to note that we received opposing opinions on this question, namely 46.30% of the surveyed teachers believe that there is too much information in primary education textbooks, and 48.30% stated that the textbooks contain insufficient information. Furthermore, when asked whether the contents of the textbooks are well-revised and aligned with the capabilities of the students, 49.09% of the respondents answered partially, and 43.64% gave a negative answer. Also noteworthy is the response of 64.81% of the surveyed teachers that the textbooks are dominated by reproductive questions and tasks intended for students, only 14.81% believe that productive questions and tasks prevail, while according to 20.37% of the surveyed teachers, problem tasks are present. When asked whether the students are able to use the textbooks independently, 55.56% of the respondents answered partially, 35.19% gave a negative answer, and only 9.26% believe that the students are able to use the textbooks independently. And on the last question, 49.09% of the surveyed teachers stated that they need additional guidance on using a specific textbook, 27.27% partially need additional training, and 23.64% do not need additional guidance.

Based on the results obtained from the survey conducted on a certain sample of teachers, as well as on the basis of our own authorial and co-authorial experiences gained in creating textbooks for primary education, in the continuation of the paper we will present scientific observations that are of exceptional importance for the production of a quality textbook.

Perceptual, intellectual and emotional attractiveness of the textbook

Modern textbooks are expected to be attractive on a perceptual, intellectual and emotional level. In order to achieve perceptual, visual attractiveness, textbooks should meet the following criteria:

- ✓ the textbook should be modernly designed (the cover and each of its pages should meet modern design standards);
- ✓ the textbook should have a modern artistic and graphic expression;
- ✓ to offer high-quality technical solutions to the text and illustrations.

In order to achieve intellectual attractiveness, the textbook should contain interesting, current content presented in a form that implies active mental, logical, creative and critical engagement of the student in arriving at new knowledge. This means:

- ✓ the titles and subtitles in the textbook should be given in the form of provocative questions;
- ✓ good structure of the presentation, which will allow for quick insight into the content of the text (precisely and consistently executed system of titles and subtitles, highlighting of important ideas and terms, conclusions and summaries);
- ✓ there should be no overly long introductions to the content, the presentation should be direct;
- ✓ only accurate and complete information and data should be presented;
- ✓ to present content intended for development, in addition to cognitive abilities and metacognition: (for improving cognitive processes, for improving the skill of individualizing cognitive activities, for improving the skill of accessing information and using it, for evaluating one's own cognitive activities);
- ✓ when presenting the content, connections should be established between learned and spontaneous knowledge, between old and new knowledge and with knowledge from other subjects;
- ✓ the content should enable the development of knowledge in accordance with the student's capabilities and abilities;
- ✓ the presentation should often be problematized (with verbal and non-verbal problem tasks that will be well-dosed and realistically achievable);
- ✓ the textbook should provide already options for choice that will suit all students, taking into account their different abilities, prior knowledge and affinities (differentiated content and problem tasks at multiple levels of complexity, simultaneous presentation of the content in different forms);
- ✓ always point to the everyday domain of application of knowledge (a sufficient number of examples should be given).

In order to ensure emotional attractiveness, it is necessary to select content that will evoke a variety of emotions, thus supporting the internal motivation and interests of students.

Textbook structure

For the successful realization of the function of the textbook, its structure is of exceptional importance, i.e. the adequate composition of the elements of the structure. In this regard, the grouping of the elements in order to ensure the necessary systematicity is particularly important.

The structure of the textbook consists of:

1. elements that serve the purpose of presenting the content;

This group of elements includes texts with the help of which the teaching contents are presented verbally and images (illustrations) are helpful when the contents are presented visually. The text can be basic and additional. The main contents are presented with the basic text. It should be clear, concise, structured in separate content units. The images and all other visual and graphic elements enable a graphic presentation of the contents, which clearly highlights the basic messages of the text and highlights the most important. This is in accordance with the cognitive process of students in the early school period,

which should be supported by clarity. The additional text serves to supplement, expand and deepen the basic text. With its help, what is presented in the basic text becomes clearer and more understandable for students.

2. elements that are in the function of adopting the contents and efficient, active learning (didactic and methodological equipment);

The didactic-methodical apparatus is in function of acquiring knowledge, developing abilities through systematized activities, as well as training students for their application. So, the main goal of these elements is to provide quality activities for students that will guarantee the acquisition of the contents. The didactic-methodical apparatus consists of questions, tasks and exercises; conclusions and reviews; art and graphic contributions; dictionary and various instructions and guidelines for students.

3. elements that are in function of easy navigation, orientation in working with the textbook.

This group of elements includes the preface, table of contents, bibliography, legends, etc. They are aimed at explaining the method of using the textbook and enable easier navigation through it.

Didactic-methodical apparatus

Volume of information

One of the key issues when assessing the quality of a textbook is the volume of information that it offers to students. It is in this regard that authors make the biggest mistake, believing that more information ensures greater scientific content. This only leads to the accumulation of too much information, which reduces the comprehensibility of the text and the possibility of successful learning. On the other hand, with the rapid development of science and technology, information is multiplied at such a speed that it is impossible to keep up. Many of them quickly become obsolete and therefore do not need to be adopted. Therefore, a key task of the author is the selection of information. This involves determining the optimal measure of information (facts, data) on the one hand and the basic messages of the text, generalizations, conclusions on the other.

Related to the previous question is the way of connecting the previous with the new knowledge. Very often, authors are unable to establish the connection between the old and the new knowledge and most often they just add the new knowledge to the old. In this way, they again burden the textbook with unnecessary information. The solution should be sought in the integration of old and new knowledge into one system, i.e. restructuring of previous knowledge and incorporating new knowledge into one system.

Presentation of content

When presenting the teaching content, the author's didactic and methodological knowledge comes to the fore. In fact, the quality of the textbook depends on the way the content is presented. This is because didactic and methodological knowledge implies the ability to shape the teaching material in a way that students will most easily understand and adopt. In the didactic and methodological design of the text, the connection with the specific sciences from which the teaching content arises is very important. However, scientific content must not be transferred in an unchanged form, but must be processed and adjusted to the age of the students, i.e. with their capabilities, abilities, cognitive characteristics, previous experiences and knowledge, etc. In doing so, care should be taken not to go to the other extreme, to the extent that the teaching content is simplifying them to the point of losing all connection with science. In this context, we will emphasize that the presentation of teaching content should be simple, but not simple, clear, concise and accessible to students. Specifically, this implies a way of presentation that will enable easy memorization of facts, understanding of concepts, laws, rules and definitions and encouraging logical thinking. In order to achieve such goals, in addition to receptive, problem-based presentation should be used wherever the nature of the teaching material allows. In this way, knowledge will not be offered to students in a ready-made form, but they will be encouraged to search for it themselves, to discover it through their own activity. In addition to this, the conclusion is that the textbook, in order to keep the attention of students, needs to be changed, i.e. the way of presenting the content should be changed.

Questions and tasks

Questions and tasks are one of the most important structural elements of the textbook. Therefore, one of the key issues is their quality and the function of the textbook. There are several types of questions, depending on the criteria that are taken into account. Most often, as a criterion, authors take the form of learning and classify questions and tasks into two groups: reproductive and productive questions. The main function of reproductive questions is memorization, i.e. repetition and confirmation of the material. The answers to these questions are found in the text and when answering them, the student's memory, attention and perception come to the fore. Unlike this type of questions, productive questions are aimed at engaging thought processes (analysis, synthesis, comparison, generalization, discovery of cause-and-effect connections and relationships, separation of the important from the unimportant, etc.) (Trebješanin, 2001). In order to answer this type of questions and tasks, students need to invest their own intellectual effort. For primary school students, it is advisable to create questions and tasks that will develop fluency, originality, flexibility and elaboration, which are characteristics of divergent creative thinking (Zuev, 1988). Due to such qualifications, questions and tasks of a productive type have greater cognitive power.

Also interesting for students are questions of the type of rebuses, crosswords, riddles, additions, labyrinths, etc., which also have a problematic nature and stimulate the student's motivation.

The textbook and the training of students for its independent use

The independent use of textbooks by students should be a continuous form of work in the real educational process. The extent to which this will be achievable largely depends on the structure of the textbooks. This implies high expectations from modern primary school textbooks, because for the textbook to enable students' independence in its use - self-learning - it is necessary for it to satisfy many principles and rules. We will try to present and emphasize several proposals for specific procedures for engaging students in the use of textbooks in natural sciences and social sciences that are in function of encouraging their activity. What we will especially emphasize is that the constant continuous practice of the activity is of particular importance. If the textbook systematically incorporates contents and procedures that, as we mentioned above, are visually, intellectually and emotionally attractive and are in function of individualizing the activity of the students, then the use of the textbook in teaching in the natural sciences and social sciences can be considered an activity that leads to individualization. What we will also emphasize, because we consider it to be particularly important, is that the textbook must facilitate learning, because, in principle, students do not want to deal with something that is difficult for them. It is important that the student, when using textbooks in natural sciences and social sciences, is confident in himself "I can do it myself". The good structure of the presentation, the author's understandable language, well-measured requirements, metacognitive guidance and the above-mentioned rules are opportunities to achieve this. It is also important that textbooks offer a good model of intellectual functioning. This includes:

- ✓ demonstrating how to think, how to notice the important, how to generalize and generalize and how to monitor one's own activity;
- ✓ describing the steps in planning or performing some activities, demonstrating skills in different ways of guidance;
- ✓ noticing and understanding information (important - unimportant, cause - consequence, similar - different);
- ✓ suggesting building one's own system for marking the text;
- ✓ tasks for independent practice of the demonstrated intellectual, self-directed and self-controlled skills;
- ✓ signaling the difficulty and type of tasks;
- ✓ signaling the criteria for success;
- ✓ encouraging self-analysis;
- ✓ guiding and directing learning processes and activities;
- ✓ Referral to other sources of knowledge is, a way of using and exchanging information (according to Trebešjanin B., 2001, p. 194).

Function of the textbook

The main function of the textbook is to support the educational process, i.e. the implementation of teaching as well as to encourage the individual work of the student. The second function is to connect the teaching content with the real everyday life of the students, thus ensuring the practical significance of acquiring knowledge, abilities and skills. The third function of the textbook is a transformational function which consists in transferring the social experience of young people in the teaching process (Zuev, 1988, p. 54) as well as in processing, systematizing and adapting scientific knowledge to the cognitive capabilities of the students.

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The Influence of Body Mass on Certain Motor Dimensions in 2ND Grade Female From Skopje

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Abstract

Physical and health education in primary schools is an integral part of the overall upbringing and education. The aim of the education is to meet the needs of pupils for movement, increasing adaptive and creative abilities, developing positive psychological traits as well as forming health habits for a healthy and hygienic life. An essential feature of physical education is the motor activities of pupils in various types and forms of physical exercise. The research was conducted on a sample of 50 female respondents, 2nd grade pupils from the city of Skopje. The aim of the research is to determine the body mass of the pupils, BMI (body mass index) body height of the pupils and to determine the biomotor abilities: strength (static of the upper extremities, explosive strength of the legs and repetitive strength of the abdominal muscles) speed (repetitive of the upper extremities, general), determining the correlations of the applied variables, The results of the research indicate that the height and weight of the female respondents are within normal limits. In all remaining morphological variables, the pupils have good results. It has been noted that the respondents have great strength of the legs, as well as strength of the upper extremities. In all respondents, according to BMI, a healthy body mass is observed.

Keywords: pupils, body mass, BMI, strength, speed

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Introduction

Physical and health education in primary schools is an integral part of the overall upbringing and education. It is promoted with the development of society. The aim of teaching is to satisfy the needs of pupils for movement, increase adaptive and creative abilities, develop positive psychological traits as well as form health habits for a healthy and hygienic life Malcev, M (2011). The aim of teaching of physical and health education is to satisfy the need for movement, to contribute to increasing adaptive and creative abilities in modern living and working conditions, and to develop a health culture. The main subject of the research – determining the influence of body mass on certain motor dimensions in 2nd grade schoolgirls from Skopje. Which will allow us to determine in what way does Body Mass Index (BMI) influence certain motor dimensions.

Literature Review

Preservation of tasks and creation of lasting habits in physical exercise to be incorporated into the overall life and culture of living. The goal of physical and health education teaching is to develop positive psychological traits, and in addition to that to form effective motor skills as well as to direct pupils to acquire knowledge, skills and habits for movement and healthy living Kohl, et al., 2013; Grissom, 2005; Welk, et al., 2010; Rasberry, et al., 2011, Međedović, E. 2005).. An essential feature of physical education is the motor activities of pupils in various types and forms of physical exercise.

Motor activities, however, are not only a means of physical exercise, especially not in a narrow sense, but also a means by which the child learns about the environment that surrounds him, satisfies the needs of his organism for movement and other life needs (Carlsen, S.A., at all 2008). The basis of good health is proper posture and body weight regulation (Ruiz, et al., 2006; Ortega,et al., 2007). Monitoring physical development in children is a powerful indicator of health status both in childhood and adolescence, and in adulthood (Guedes, et al., 2012; Blair, et al. 2001; Williams, 2001; Myers, et al., 2004; Warburton, et al., 2005; Ortega et. al. 2008).

While poor posture and increased body mass cause the appearance of various deformities that are then reflected in the work of the cardiovascular system, respiratory, digestive organs and the functions of proper growth and development of the organism (Moliner-Urdiales, et al., 2010, Ruiz, et al., 2006), .One of the basic health and hygiene tasks of physical and health education that are realized through the teaching process is the acquisition of resistance and strengthening of health from every aspect. The proper organization of physical and health education classes in changing conditions of the external environment, exercise in fresh and clean air, in snow, in water, in nature in general, has a particularly positive effect on all organs and organic systems and contributes to the regulation of body mass. The child should get used to daily exercise that will increase his resistance to the influences of the external environment.

Methods

Subject of the research

The subject of the research of the paper is to determine the influence of body mass on certain motor dimensions in 2nd grade pupils from Skopje.

Research objectives

- Determining the body mass of 2nd grade pupils

- Determining BMI (body mass index)

- Determining the body height of pupils

- Testing biomotor abilities:

a) strength (static upper limbs, explosive leg strength and

repetitive abdominal muscle strength)

b) speed (repetitive upper limbs, general)

- determining correlations of the applied variables

Sample of respondents

The research was conducted on a sample of 50 female respondents, 2nd grade pupils from the territory of the city of Skopje

The research was conducted by professors with the help of pupils from the Faculty of Pedagogy. The measurements were performed in the morning hours, in the school halls.

Instruments for data collection

The data were collected with specially prepared measurement sheets containing all the necessary parametric data that enable the application of appropriate statistical procedures.

Sample of variables

Morphological variables:

body weight, body height, average abdominal circumference, upper arm circumference, upper leg circumference, average chest circumference

Biomotor variables: lifting the trunk from the ground (PTP), tapping with the better hand (TPR), long jump from a standing position (SDM), height in a squat (VIZ), running 5x10m. (T5x10).

Data processing method

The following central and dispersive statistical parameters were calculated for each applied variable:

arithmetic mean (AS), standard deviation (SD);, assessment of the distribution of the results was tested with skewness (Sk); homogeneity of the results was tested with kurtosis (Ku); minimum (Min) result; maximum (Max) result, determination of BMI analysis of partial correlation,

All statistical procedures were calculated with modern statistical packages.

Findings

The central and dispersive parameters of the morphological and biomotor variables in 2nd grade pupils are presented in Table 1

Table 1.
The central and dispersive parameters of the morphological and biomotor variables in 2nd grade pupils

	AS	SD	Skw	Kurt	Min	Max
TT	27.00	6.53	0.79	-0.45	18.5	40
TV	127.41	7.07	0.38	-0.63	116	142
OSTO	64.52	7.01	0.62	-0.47	54	78
NADL	19.65	2.95	0.27	-0.82	15	25
NATK	38.09	5.58	0.40	-1.11	30	48
OGRA	60.61	6.56	1.40	2.18	52	80
SKOK	106.30	18.29	0.50	-0.04	75	150
PODI	12.00	3.22	-1.07	1.28	3	16
TRC	13.52	2.38	3.99	17.88	11.67	23.87
ZGIB	22.03	10.54	1.33	1.79	7.61	50.69
TAPI	24.69	2.62	-0.49	-0.24	18.61	29.26

We note that the arithmetic mean (AS) of the body weight variable (TT) is 27.00 kg., the remaining indicators indicate a wide, i.e. platykurtic homogeneity of the results with a value of -0.45

The value of the arithmetic mean (AS) indicates that the respondents in the variable (TV body height) are on average 127.41 cm tall. From the dispersion of the results (SD) we note that there is a relative deviation from the normal distribution, with leptokurtic asymmetry.

In the variable (OSTO, Abdominal circumference), it is noted that the dispersion of the results (SD) is not within the limits of symmetry, with values of the arithmetic mean (AS), which is 64.52 cm. The homogeneity of the results is with platykurtic homogeneity, which is indicated by the values of kurtosis (Ku -0.47).

Relative platykurtic homogeneity of the kurtosis values (Ku) -0.82 is observed in the variable (upper arm circumference (NADL). The value of the (AS) arithmetic mean is 19.65 cm.

We note in the variable (NATK - upper leg circumference), that the upper leg circumference of the respondents is - AS 38.09 cm., the asymmetry is Sk 0.40, which indicates moderate asymmetry.

We note in the variable (OGRA, chest circumference), that the arithmetic mean (AS) is 60.61 cm. The asymmetry of the results - skewness (the test is difficult) Sk 1.40. We also note that the homogeneity of the results is Ku 2.18, i.e. a wide - platykurtic form of the homogeneity of the results.

In the variable (SKOK - Jump in distance from a place), It is noted that the dispersion of the results (SD) – the variation, is within the standard values of 1/3 of the AS and is 18.29. The value of the arithmetic mean (AS) is 106.30 cm.

The values of the arithmetic mean (AS) indicate that the respondents in the variable (PODI Lifting the trunk from the base) are 12.00 where the minimum result is 3 lifts, and the maximum is 16 lifts.

We note in the variable (TRC5x10m), that the arithmetic mean (AS) is 13.52. The asymmetry of the results - skewness Sk is positively directed 3.99 (the test is difficult). We also note that the homogeneity of the results is with a value of Ku 17.88, i.e. with narrow - leptokurtic homogeneity.

The values of the arithmetic mean (AS) indicate that the respondents in the variable (ZGIB - Height in bend) are relatively moderate and it is 22.03. From the dispersion of the results (SD) we note that there is no relative deviation (SD 10.54).

For the variable (TAPI - Tapping with hand), it is noted that the dispersion of the results (SD) is within the limits of the deviation with values (2.62), as well as the values of the arithmetic mean (AS), which is 24.69. The homogeneity of the results is positive, with wide asymmetry, as indicated by the kurtosis values (Ku -0.24).

Discussion, Conclusion, and Suggestions

Considering the main subject of the research – determining the influence of body mass on certain motor dimensions in 2nd grade schoolgirls from Skopje, which was realized through 11 variables that determine the morphological and biomotor status of 7-year-old pupils, and based on the obtained records of data from basic statistics that relate to the morphological and biomotor status of 2nd grade schoolgirls from Skopje, the following conclusions can be drawn:

From the obtained results, it is evident that the height and weight of the female respondents are within normal limits, according to the available literature, and in all remaining morphological variables, the pupils have good results. All respondents have a healthy body mass according to BMI.

BMI Results and Interpretation

The reference values of the body mass index were analyzed according to the categorization of the ‘‘Centers for Disease Control and Prevention’’.

Table 2.
Body Mass Index (BMI)

BMI	(**BMI** <14,8)	(14,8≤ **BMI** <21,8)	(21,8≤ **BMI** <25,2)	(**BMI** ≥25.2)
Female		16.77		

Due to the simplicity of calculating and assessing obesity, in the world and in our country, the most popular and most widely used method for assessing the level of nutrition is the Body Mass Index (BMI), which is a significant indicator of the state of nutrition and the health differences that this state affects.

From the results shown in table no. 2, we note that pupils at the age of 7, on average, belong to the "healthy body mass" group.

Results and interpretation of partial correlation coefficients

With the correlation analysis we want to determine the mutual connection of the variables that treat anthropometric variables (morphological) and the relations of motor abilities. This especially applies to the individual correlation of anthropometric and motor variables. The data obtained in this way can have further application in the latent multivariate space. They are shown in table no. 3.We note, among the 2nd grade pupils, that out of a total of 42 significant correlation coefficients, 20 are high (with values from .70 to .90), 16 are medium (with values from .40 to .70), the remaining 6 correlation coefficients are with values above .90. (Table no. 3).

Table 3.
female, correlation coefficients

	1	2	3	4	5	6	7	8	9	10	11
TT	X	**0.88**	**0.84**	**0.94**	**0.95**	**0.84**	0.18	0.00	-0.27	**-0.48**	-0.02
TV	**0.88**	X	**0.67**	**0.76**	**0.78**	**0.67**	0.19	-0.03	-0.35	**-0.41**	-0.10
OSTO	**0.84**	**0.67**	X	**0.80**	**0.76**	**0.84**	0.01	-0.11	-0.18	-0.26	0.09
NADL	**0.94**	**0.76**	**0.80**	X	**0.95**	**0.85**	0.15	-0.05	-0.23	**-0.51**	0.11
NATK	**0.95**	**0.78**	**0.76**	**0.95**	X	**0.83**	0.26	0.14	-0.25	**-0.53**	-0.04
OGRA	**0.84**	**0.67**	**0.84**	**0.85**	**0.83**	X	0.15	0.04	-0.19	**-0.45**	0.02
SKOK	0.18	0.19	0.01	0.15	0.26	0.15	X	**0.46**	0.36	-0.19	-0.03
PODI	0.00	-0.03	-0.11	-0.05	0.14	0.04	**0.46**	X	0.15	-0.11	-0.21
TRC	-0.27	-0.35	-0.18	-0.23	-0.25	-0.19	0.36	0.15	X	-0.02	0.18
ZGIB	**-0.48**	**-0.41**	-0.26	**-0.51**	**-0.53**	**-0.45**	-0.19	-0.11	-0.02	X	-0.09
TAPI	-0.02	-0.10	0.09	0.11	-0.04	0.02	0.03	-0.21	0.18	-0.09	X

Variable 1 (body weight) has 4 statistically significant, very high and positive correlation coefficients with variables 4 and 5 that determine upper arm circumference and chest circumference, a high and positive correlation with variable 3 (abdominal circumference). Variable 1 has a relatively medium and negative correlation with variable 10, i.e. with the variable that determines the strength of the arms and shoulder girdle (height in flexion). (Table 3).

Body height (variable 2) has a statistically positive and medium correlation with variables 3 and 6, i.e. with abdominal circumference, thigh circumference, and a negative correlation with variable 10 (height in flexion). A high correlation is observed with variables 1, 3 and 5 (body weight, abdominal circumference and thigh circumference). (Table 3).

We note that variable no. 3 (abdominal circumference) has a statistically positive and high correlation with variables 1 (TT), 4 (NADL), 5 (NATK) and 6 (OGRA). A medium correlation is observed with variable 2 (TV). (Table no. 3).

Upper arm circumference (Var.4) has a relatively high and positive correlation with variables 2, 3, and 6 that determine body height, abdominal circumference, and chest circumference. A medium negative

correlation is observed with variable 10 (height at the hip). This variable has a very high correlation with variables 1 (body weight) and variable 5 (upper leg circumference). (Table 5).

Variable 5 (upper leg circumference) has a relatively very high and positive correlation with variables 1 and 4 that determine body weight and upper arm circumference, a high correlation with variables 2 (body height), 3 (abdominal circumference), and 6 (chest circumference). A medium and negative correlation is observed with variable 10 – height at the hip. (Table 3).

Variable 6 (chest circumference) has relatively high and positive correlation coefficients with variables 1, 3, 4, and 5, i.e. body weight, abdominal circumference, upper arm circumference, and thigh circumference. It has a relatively medium positive correlation with variable 2 (body height) and a negative correlation with variable 10 - height at the hip. (Table 3).Long jump from a place (Var.7), has a statistically significant relationship with one variable 8 – lifting the trunk from the base. (Table No.3).

We note in variable 8 (lifting the trunk from the base) that there is a statistically significant medium relationship with long jump from a place (Var.7), (Table No.3).

Running 5x10 m. (Var.9), has no statistically significant relationship with any variable. (Table No.3).

Variable 10 (height in bend) has a medium and negative correlation with the variables: 1 –TT, 2 – TV, 4 - NADL, 5 - NATK and 6 - OGRA. Table No.5).

The last variable 11 (tapping with the better hand), has no statistically significant relationship with any variable. (Table No.3).

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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The Effect of Project-Based Learning Activities Based on Collaborative Learning on Students' Academic Grit and Metacognitive Awareness

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Abstract

This study, which investigates the effect of the project-based learning approach based on collaborative learning on students' academic grit and metacognitive awareness, used a pre-test-post-test control group quasi-experimental design. This research was conducted with 88 third-grade students attending a primary school in Edirne Provincial Center during the spring semester of the 2024-2025 academic year. The data were collected using the Academic Grit Scale, developed by Rojas et al. (2012) to determine the academic grit levels of primary and secondary school students and adapted into Turkish by Bozgün and Başgül (2018), and the "Metacognitive Awareness Scale" developed by Sperling et al. (2002) and evaluated for its applicability in Turkey by Karakelle and Saraç (2007). According to the results of the study, a significant difference was found between the pre- and post-experiment scores of the Experiment 1, Experiment 2, and control groups in terms of students' academic grit scores, and this situation was interpreted as indicating that students' academic grit gained momentum over the course of the process. In terms of metacognitive awareness, a significant difference was observed in the pre- and post-experiment metacognitive awareness of the Experiment 1 group, while no significant difference was observed between the pre- and post-experiment scores of the Experiment 2 and control groups. It is thought that the reason for the significant difference in the Experiment 1 group was due to the students' sharing with each other and peer learning behaviors during the collaborative project-based learning process. Various recommendations have been developed based on the data obtained from the research.

Keywords: Project-based learning, collaborative learning, academic grit, metacognitive awareness

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Introduction

Today's educational approach involves adopting methods and approaches that not only transfer knowledge but also actively engage students in the learning process (Ün Açıkgöz, 2002). From this perspective, student-centered approaches enable individuals to take responsibility for their own learning, control their learning processes, and achieve lasting learning through activities based on real-life situations (Yağan, 2021).

One such approach, project-based learning, is a student-centered approach that involves addressing a real-life problem situation in the context of planning, research, product creation, collaboration, and communication (Kokotsaki et al., 2016). The effective implementation of the project-based learning process in the classroom is closely related to ensuring collaboration among students (Zhang & Ma, 2023). Engaging in collaborative project work encourages students to think about different ideas and participate in constructive discussions (Chistyakov et al., 2023).

During this process, students both manage their own learning processes and develop solution strategies for the challenges they encounter throughout the process. These concepts, referred to as metacognitive awareness and academic grit, are frequently used in various student-centered approaches. A review of the research shows that collaborative learning has been examined in relation to metacognitive awareness (Çini et al., 2020) and academic grit (Gat et al., 2022) in different studies. There are also studies that examine metacognitive awareness in conjunction with the project-based learning approach (Sart, 2014). However, there is no study that uses the concepts of academic grit and metacognitive awareness together with the project-based learning and collaborative learning approaches. In this context, integrating the collaborative learning approach into the project-based learning approach and examining the effect of this learning process on students' academic grit and metacognitive awareness is important for understanding the holistic effects of student-centered approaches. Therefore, the purpose of this study is to examine how the project-based learning approach based on collaborative learning affects students' academic grit and metacognitive awareness. In this regard, the research question was formulated as "What is the effect of collaborative project-based learning activities on students' academic grit and metacognitive awareness?" and the following hypotheses were developed.

Hypotheses

1. There is a significant difference between the effects of collaborative project-based learning activities, individual project-based learning activities, and classes where project-based learning is not implemented on students' academic grit.

2. There is a significant difference between the effects of collaborative project-based learning activities, individual project-based learning activities, and classes where project-based learning is not implemented on students' metacognitive awareness.

Literature Review

Collaborative Learning and Project-Based Learning

Collaborative project-based learning is an approach to learning in which students work together on a defined problem or situation and collectively carry out the planning, research, analysis, and design processes. According to this approach, the learning process is based on interaction and active participation, and project tasks are designed as collaborative work (Wolff, 2003). Collaborative learning is a teaching method in which students work together in small groups toward a common goal (Üç Açıkgöz, 2002). In this process, students learn to distribute tasks within the group, respect each other's ideas, and reach a consensus (Laal & Ghodsi, 2012). In this regard, for collaborative learning to take place, group members must support each other's learning and maximize it (Şener, 2024).

Collaborative student groups can produce a tangible product at the end of the learning process. In this approach, called project-based learning, students go through stages such as planning and research based on a defined problem situation and produce a tangible product (Demirhan & Demirel, 2016). Student groups develop applicable solution strategies by working collaboratively to solve the problem situation. These student groups consist of students with different interests and abilities (Sanchez & Vidal, 2013). In this respect, teamwork and communication are fundamental elements of the collaborative project

development process (Garcia-Varcarcel & Basilotta, 2017). The collaborative implementation of the project-based learning process develops students' problem-solving, self-regulated learning, and communication skills (Lee et al., 2024). Furthermore, students' learning becomes more permanent as they are active throughout the process and construct knowledge themselves (Benli & Sarikaya, 2012).

Academic Grit and Metacognitive Awareness

In student-centered learning environments, students' efforts in tasks such as researching, applying, and producing a tangible product are explained by the concept of academic grit. Academic grit is the tendency of individuals to continue working with determination in the face of difficulties, persisting in their efforts to achieve their goals despite failure and stagnation in progress (Duckworth et al., 2007). To establish a strong relationship between grit and success, students need to set success in that area as a long-term goal and review their short-term goals in the face of difficulties (Jordan et al., 2019). High levels of academic grit among students positively affect success in the learning process (Eryiğit & Kılıç, 2022), psychological well-being (Jin & Kim, 2017), and self-confidence and determination (Mohan & Kaur, 2021).

Wolters and Hussain (2015) stated that grit is related to self-regulated learning strategies and increases students' tendency to use metacognitive strategies, one of these strategies. The concept of metacognition, which refers to students' awareness of their own learning processes and their ability to manage this process independently of the teacher, is the individual's ability to monitor, evaluate, and regulate their own thinking processes (Kalemkuş, 2021; Karakelle & Saraç, 2010). Students with high metacognitive awareness can more effectively choose learning strategies that suit them by being aware of what they know and do not know in their learning processes, and they can improve their learning processes by recognizing their mistakes (Livingston, 2003). In this regard, collaborative learning and project-based learning have a positive and meaningful effect on students' metacognitive awareness (Batdı, 2013; Kalemkuş & Bulut Özek, 2022)

Method

Research Design

This study, which investigates the effect of project-based learning activities based on collaborative learning on students' academic grit and metacognitive awareness, used a pre-test-post-test control group quasi-experimental design. Experimental studies are studies in which cause-and-effect relationships between variables are tested under the control of the researcher. In this process, the researcher directly manipulates the independent variable and compares the measurements of the dependent variable (Büyüköztürk, 2024).

Table 1.
Experimental Design Used in the Study

Group Name	Pre Test	Experimental Procedure	Post Test
Experiment 1	AGS+MAS	Collaborative Project-Based Learning	AGS+MAS
Experiment 2	AGS+MAS	Project-Based Learning	AGS+MAS
Control	AGS+MAS	MEB Elementary School Program	AGS+MAS

As shown in Table 1, the research design consists of two experimental groups and one control group. At the beginning of the study, the Academic Grit Scale and the Metacognitive Awareness Scale were administered to the groups as pre-tests.

The experimental process lasted 6 weeks, and Experiment 1 group was assigned project-based learning activities based on collaborative learning, while Experiment 2 group was assigned individual project-based learning activities. In the control group, no project work was done, and the curriculum topics were followed in the lessons throughout the process.

The Academic Grit Scale and Metacognitive Awareness Scale were re-administered to the groups the week after the experimental process.

Study Group

The research was conducted in the spring semester of the 2024-2025 academic year with 88 third-grade students attending a primary school in Edirne Provincial Center, using purposive sampling (Yıldırım & Şimşek, 2021) in line with the first researcher's capabilities. Two of the three classes available at the school were randomly selected as the experimental group and the control group. Information about the distribution of participants is shown in Table 2.

Table 2.
Distribution of Participants

Groups	Classes	n	%
Experiment 1	3/A	30	34
Experiment 2	3/B	32	36
Control	3/C	26	30
Total		88	100

Table 2 shows the distribution of the study groups according to classes. Accordingly, the working group forming Experiment 1, where project-based learning based on collaborative learning took place, consisted of n=30 students; the working group forming Experiment 2, where individual project-based learning took place, consisted of n=32 students; and the working group in the group where project-based learning did not take place and the process continued according to the MEB curriculum consisted of n=26 students.

Data Collection Tools

The “Academic Grit Scale” developed by Rojas et al. (2012) to determine the academic grit levels of elementary and middle school students was used as the data collection tool in the study. The validity and reliability studies of the scale's adaptation into Turkish were conducted by Bozgün and Başgül (2018). The scale consists of 10 items and a single dimension.

Another data collection tool used in this study is the “Metacognitive Awareness Scale” developed by Sperling et al. (2002) to measure the metacognitive skills of 3rd-9th grade students, whose applicability in Turkey was evaluated by Karakelle and Saraç (2007). The A form of the scale, prepared for 3rd, 4th, and 5th grade students, consists of 12 items. This scale aims to identify students' abilities to monitor, evaluate, and regulate their own learning processes.

Experimental Procedure

After obtaining the necessary administrative permissions along with ethical approval to conduct the study at a primary school in the central district of Edirne Province, the teachers of Experiment 1, Experiment 2, and the control group were interviewed. As a result of the interviews, it was decided that the applications in the experimental groups would be carried out during the Free Activities class for 2 class hours per week for 6 weeks.

Project topics related to the learning outcomes of Turkish, mathematics, life skills, science, physical education and games, visual arts, and music lessons were created to carry out the experimental procedure in the study. Project work was not implemented in the control group.

The following steps were followed during the research:

1. The Academic Grit Scale and the Metacognitive Awareness Scale were administered as pre-tests to all three groups.
2. The experimental and control groups were formed.
3. Working groups were formed in the Experimental 1 group, students selected their project topics, and group dynamics formation activities were carried out.
4. Planning of students' projects in the experimental groups.

5. Development of projects by the experimental groups over a period of 3 weeks. Presentation of projects by students in the 4th week.
6. Application of the Academic Grit Scale and the Metacognitive Awareness Scale as a post-test to all three groups.

Data Analysis

The following statistical methods and techniques were used to analyze the data collected in this study:

1. Frequency, percentage, and ratio of the study group and the distribution of students in this group
2. Cronbach's Alpha coefficient for the reliability of the scales
3. Shapiro-Wilks test and Skewness Kurtosis values to test whether the data obtained from the research showed a normal distribution
4. Mann Whitney U test was used to test the difference between means in non-parametric groups, and Wilcoxon Signed Ranks test was used to test the difference between pre-test and post-test means.
5. The research data were analyzed using the SPSS 22 program.

The reliability of the scales was confirmed, and the reliability of the academic grit scale was found to be sufficient for application, with a pre-test Cronbach's Alpha value of 0.58 and a post-test Cronbach's Alpha value of 0.60. Looking at the reliability of the metacognitive awareness scale, the pre-test Cronbach's Alpha value for metacognitive awareness was 0.63 and the post-test Cronbach's Alpha value was 0.74, which was again found to be sufficiently reliable for application.

To examine the distribution of the data obtained in the study and to test whether it showed a normal distribution, the Shapiro-Wilks test was applied due to the group size being less than 50, and skewness and kurtosis values were also taken into account (Büyüköztürk, 2008). Looking at the normality test findings, the Shapiro-Wilks results for the academic grit scale and the metacognitive awareness scale had p values less than 0.05, indicating that the scores deviated from a normal distribution at this level of significance. Furthermore, the skewness and kurtosis values were not within the range of (-1, +1) in some of the results. For these reasons, nonparametric analyses were used in the research analyses.

Findings

This section of the study presents findings and interpretations regarding the impact of the project-based learning approach based on collaborative learning on students' academic grit and metacognitive awareness in tabular form.

The first hypothesis of the study was formulated as follows: *"There is a significant difference between the effects of collaborative project-based learning activities, individual project-based learning activities, and classes where project-based learning is not implemented on students' academic grit."* The results of the statistical analyses regarding this hypothesis, obtained through pre-test and post-test findings on whether there was a significant difference between the groups, are presented below as arithmetic means, standard deviations, and Kruskal-Wallis H Test results for independent measurements.

Table 3.

Arithmetic Mean and Standard Deviation Scores for Academic Grit Scale Pre-test and Post-test Scores

Test	Group	$\bar{X}$	ss
Pre test	E1	28,83	0,82
	E2	30,50	0,62
	C	29,73	0,76
Post test	E1	33,83	0,88
	E2	35,87	0,59
	C	31,15	0,74

As shown in Table 3, according to the pre-test results of the academic grit scale, the arithmetic mean ($\bar{X}$=28.83) and standard deviation (S=0.82) of the Experiment 1 group, the arithmetic mean ($\bar{X}$=30.50) and standard deviation (S=0.62), and the control group arithmetic mean ($\bar{X}$=29.73) and standard deviation (S=0.76). According to the post-test results, the arithmetic mean of the Experiment 1 group ($\bar{X}$=33.83) and standard deviation (S=0.88), the arithmetic mean of the Experiment 2 group ($\bar{X}$=35.87), standard deviation (S=0.59), the arithmetic mean of the control group ($\bar{X}$=31.15), standard deviation (S=0.74) were obtained. These data show an increase in the arithmetic means of the students in terms of academic grit during the experimental process.

Table 4.
Kruskal-Wallis H Test Results for Pre-Test Scores on the Academic Grit Scale

Group	n	Rank mean	sd	X^2	p	Difference
E1	30	40,45	2	1,73	0,419	Not significant
E2	32	48,91				
C	26	43,75				

Table 4 shows that no significant difference was found between Experiment 1, Experiment 2, and the control groups in terms of the academic grit scale pre-test results [X^2(df=2, n=88) =1.73, p>0.05]. This situation can be interpreted as the three groups being equivalent at the beginning of the experimental procedure.

Table 5.
Kruskal-Wallis H Test Results for Academic Grit Scale Post-Test Scores

Group	n	Rank mean	sd	X^2	p	Difference
D1	30	40,74	2	1,53	0,465	Not significant
D2	32	48,45				
K	26	44,29				

Table 5 shows that no significant difference was found between Experiment 1, Experiment 2, and the control groups in terms of the final test results of the academic grit scale [X^2(df=2, n=88) =1.53, p>0.05]. This indicates that there was no significant difference between the three groups at the end of the experimental process. However, looking at Table 3, the fact that the arithmetic mean increase in the final test in the experimental groups is higher than that in the control group suggests that the methods applied were effective in stimulating the children's academic grit scores.

Table 6.
Wilcoxon Signed-Rank Test Results for Pre-Test and Post-Test Scores on the Academic Grit Scale

Group	Post-test-Pre-test	n	Rank Mean.	Rank Sum.	z	p	Difference
E1	Negative Rank	2	10,00	20	4,27	0,00	Significant
	Positive Rank	27	15,37	415			
	Equal	1	-	-			
E2	Negative Rank	2	2	4	4,79	0,00	Significant
	Positive Rank	29	16,97	492			
	Equal	1	-	-			

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C	Negative Rank	12	0,00	0,00	4,47	0,00	Significant
	Positive Rank	13	13,50	351			
	Equal	1	-	-			

Table 6 shows the results of the Wilcoxon Signed-Rank test conducted to determine whether there was a significant difference in children's academic grit scores before and after the experiment. According to the results, there was a significant difference between the pre- and post-experiment scores of the experimental group (z=4.27, p=0.00) and the control group (z=4.47, p=0.00). This indicates that there was a significant difference in the pre- and post-experiment scores of the children's academic grit. p=0.00), and the control group (z=4.47, p=0.00) showed a significant difference between their pre- and post-experiment scores. This situation can be interpreted as the students' academic grit gaining momentum during the process.

The second hypothesis of the study was formulated as follows: *"There is a significant difference between the effects of project-based learning activities based on collaborative learning and individual project-based learning activities and the effects of classrooms where project-based learning is not implemented on students' metacognitive awareness."* The findings obtained through pre-test and post-test to determine whether there was a significant difference between the groups in the statistical analyses related to this hypothesis, along with the arithmetic mean, standard deviation, and Kruskal-Wallis H Test results for independent measurements, are presented below.

Table 7.
Arithmetic Mean and Standard Deviation Scores for Pre-Test and Post-Test Scores on the Metacognitive Awareness Scale

Test	Group	$\bar{X}$	ss
Pre test	D1	28,46	0,53
	D2	30,09	0,61
	K	29,88	0,66
Post test	D1	29,60	0,70
	D2	30,56	0,65
	K	29,65	0,64

As shown in Table 7, based on the pre-test results of the metacognitive awareness scale, the arithmetic mean ($\bar{X}$=28.46) and standard deviation (S=0.53) for the Experiment 1 group, the arithmetic mean ($\bar{X}$=30.09) and standard deviation (S=0.61), the control group arithmetic mean ($\bar{X}$=29.88), standard deviation (S=0.66) were obtained. According to the post-test results, the arithmetic mean of the Experiment 1 group ($\bar{X}$=29.60), standard deviation (S=0.70), the arithmetic mean of the Experiment 2 group ($\bar{X}$=30.56), standard deviation (S=0.65), the arithmetic mean of the control group ($\bar{X}$=29.5), standard deviation (S=0.64) were obtained. These data show that the collaborative project-based learning and individual project-based learning methods applied in the experimental process increased the arithmetic means of students' metacognitive awareness, while this increase was not observed in the control group.

Table 8.
Kruskal-Wallis H Test Results for Pre-Test Scores on the Metacognitive Awareness Scale

Group	n	Rank mean	sd	X^2	p	Difference
E1	30	35,67	2	5,50	0,064	Not significant
E2	32	49,19				

C	26	48,92				

Table 8 shows that no significant difference was found between Experiment 1, Experiment 2, and the control groups in terms of pre-test results on the metacognitive awareness scale [X^2(df=2, n=88) =5.50, p>0.05]. This situation can be interpreted as indicating that the three groups were equivalent in terms of metacognitive awareness at the beginning of the experimental procedure.

Table 9.
Kruskal-Wallis H Test Results for Post-Test Scores on the Metacognitive Awareness Scale

Group	n	Rank mean	sd	X^2	p	Difference
E1	30	42,05	2	1,53	0,465	Not significant
E2	32	48,94				
C	26	41,87				

Table 9 shows that no significant difference was found between Experiment 1, Experiment 2, and the control groups in terms of the final test results of the metacognitive awareness scale [X^2(df=2, n=88) =1.53, p>0.05]. This indicates that there was no significant difference between the three groups at the end of the experimental procedure. However, Table 7 shows that although there was an increase in the arithmetic mean of the final test in the experimental groups, there was a decrease in the control group, indicating that the methods applied were effective in activating the children's metacognitive awareness scores.

Table 10.
Wilcoxon Signed-Rank Test Results for Pre-Test and Post-Test Scores on the Metacognitive Awareness Scale

Group	Post-test-Pre-test	n	Rank Mean	Rank Sum.	z	p	Difference
E1	Negative Rank	12	10,17	122	4,27	0,00	Significant
	Positive Rank	15	17,07	256			
	Equal	3	-	-			
E2	Negative Rank	11	12,45	137	0,98	0,32	Not significant
	Positive Rank	15	14,27	214			
	Equal	6	-				
C	Negative Rank	12	14,92	179	0,44	0,65	Not significant
	Positive Rank	13	11,23	146			
	Equal	1	-				

Table 10 shows the results of the Wilcoxon Signed-Rank Test conducted to determine whether there was a significant difference in children's metacognitive awareness before and after the experiment. According to the results, a significant difference was observed in the Experiment 1 group (z=4.27, p=0.00) No significant difference was observed between the pre- and post-test scores in Experiment 2 (z=0.98, p=0.32) and the control group (z=0.44, p=0.65). It is thought that the reason for the significant difference in the Experiment 1 group was due to the students' sharing with each other and peer learning

behaviors in the collaborative project-based learning process. The fact that the students in the Experiment 2 group were developing individual projects and that the students in the control group were not involved in the experimental process may be the reason for the lack of a significant difference.

Discussion, Conclusion, and Suggestions

According to the results of this study, which examined the effect of the project-based learning approach based on collaborative learning on students' academic grit and metacognitive awareness, no significant difference was found between Experiment 1, Experiment 2, and the control groups in terms of the pre-test results of the academic grit scale. This situation can be interpreted as the three groups being equivalent at the beginning of the experimental process.

In terms of post-test results, no significant differences were found between Experiment 1, Experiment 2, and the control groups. This situation shows that there was no significant difference between the three groups at the end of the experimental process. However, the fact that the arithmetic mean increase in the final test in the experimental groups was higher than that in the control group suggests that the methods applied were effective in stimulating children's academic grit scores. Various studies have also shown that collaborative learning environments increase students' academic grit (Gat et al., 2022). Furthermore, collaborative learning is effective in developing other concepts related to the concept of academic grit, such as motivation (Loes, 2022), academic resilience, and self-efficacy (Wang et al., 2023). Mendo-Lazaro et al. (2022) stated that collaborative learning encourages students to develop goals aimed at acquiring new knowledge and skills. Similarly, project-based learning activities increase self-regulated learning by encouraging students to set goals, make plans to achieve those goals, and exert effort in the process (Wu, 2024). It also has a positive effect on increasing the perception of self-efficacy for academic achievement (Spigner, 2023).

However, there is a significant difference between the pre- and post-experiment scores of Experiment 1, Experiment 2, and the control groups. This can be interpreted as students' academic grit gaining momentum over the course of the process. Academic grit is influenced by various factors in learning environments, such as teacher support, peer relationships, and classroom climate, and can develop over time. A review of the research indicates that social support from teachers and a positive classroom environment provided by teachers (Clark et al., 2020) increase grit, effort, and interest in students who encounter academic obstacles (Zhong & Wang, 2025). Along with teacher support, peer support and positive student relationships also enhance academic grit and motivation (Kiefer et al., 2015). Wong et al. (2021) stated that supportive classroom and school environments increase students' grit and self-efficacy levels over time, while reducing academic stress and hopelessness levels.

No significant differences were found between Experiment 1, Experiment 2, and the control groups in terms of students' metacognitive awareness pre-test results for the project-based learning approach based on collaborative learning. This situation can be interpreted as the three groups being equivalent in terms of metacognitive awareness at the beginning of the experimental procedure.

Similarly, no significant differences were found between Experiment 1, Experiment 2, and the control groups in terms of post-test results on the metacognitive awareness scale. This indicates that there was no significant difference between the three groups at the end of the experimental process. However, despite the increase in the arithmetic mean of the final test in the experimental groups, the decrease in the control group shows that the methods applied were effective in stimulating children's metacognitive awareness scores. Project-based learning activities encourage students to make plans to achieve their goals. This involves students taking responsibility for their learning processes, working collaboratively, and seeking help from their peers (Wu, 2024). When the studies conducted are examined, the collaborative learning method develops students' metacognitive skills and their ability to manage their own learning processes (Erdoğan & Şengül, 2017; Tran, 2019). In addition, project-based learning activities also have a positive effect on students' metacognitive awareness (Kalemkuş & Bulut Özek, 2022; Sart, 2014).

However, while a significant difference was observed in the metacognitive awareness of children in the Experiment 1 group before and after the experiment, no significant difference was observed between the pre- and post-test scores of the Experiment 2 and control groups. It is thought that the reason for the

significant difference in the Experiment 1 group is due to the students' sharing with each other and peer learning behaviors in the collaborative project-based learning process. The fact that students in the Experiment 2 group were developing individual projects and that students in the control group were not involved in the experimental process may be the reason for the lack of a significant difference. Peer support involves collaborative learning and working together. This allows students to share their ideas with each other, evaluate each other's perspectives, and monitor their learning processes. Thus, students reflect on their peers' and their own learning processes, thereby developing their metacognitive awareness (Wen & Castek, 2024). Furthermore, peer assessment studies emphasize that evaluating classmates enables students to adopt reflective, critical thinking strategies, thereby increasing self-regulated learning and metacognitive awareness (Ortega-Ruiperez & Correa-Gorospe, 2024).

Based on all this, the following recommendations have been developed in the study:

1. Studies can be repeated in longer-term, different experimental settings and with different methods regarding academic grit and metacognition.
2. Studies can be conducted using different demographic variables that examine the relationship between academic grit and metacognition.
3. Different learning processes can be developed where children can work collaboratively and peer teaching environments can be increased.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Babakultur trifft Stereotyp im DaF-Unterricht: Interkultureller Vergleich der Erziehungsformen in Kaya Yanars Made in Germany

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Abstract

Dieser Artikel untersucht die Rolle von Humor in der deutsch-türkischen Jugendliteratur und den Medien, mit besonderem Fokus auf die humorvolle Darstellung kultureller Identität. Seit den 1990er Jahren zeichnet sich ein Wandel ab, bei dem kulturelle Themen in Literatur, Film und Fernsehen verstärkt spielerisch und humorvoll behandelt werden. Culture-Clash-Komödien und humorvolle Darstellungen in Jugendbüchern und Serien bieten Jugendlichen wichtige Identifikationsmöglichkeiten, indem sie kulturelle Vielfalt als Stärke präsentieren. Der Ausgangspunkt dieser Arbeit ist die Trendshow *Made in Germany* von Kaya Yanar, in der interkulturelle Vergleiche humorvoll aufgezeigt werden. Die vorliegende Arbeit zielt darauf ab, humorvolle Klischees und interkulturelle Herausforderungen anhand Stereotypen, die das kollektive Bild von multikultureller Identität prägen, kontrastiv zu vergleichen. In diesem Kontext orientiert sich diese Arbeit am handlungsorientierten Ansatz und versucht, didaktische Vorschläge für den DaF-Unterricht auf dem B1/B2 Niveau darzustellen. Dabei wird ein besonderes Augenmerk auf Erziehungsformen der Eltern in unterschiedlichen Kulturen gelegt. Die Darstellung der Eltern in der analysierten Folge wird mittels der Dokumentenanalyse qualitativ ausgewertet und visuell vorgestellt. Diese Dokumentenanalyse setzt sich das Ziel, die Erziehungswerte unterschiedlicher Kulturen im DaF-Unterricht kontrastiv darzulegen und kulturelles Lernen im DaF-Unterricht zu fördern. Die Arbeit zeigt, dass Humor nicht nur die Lernerfahrung bereichert, sondern auch ein effektives Mittel darstellt, um kulturelle Unterschiede spielerisch und reflexiv zu thematisieren.

Schlüsselwörter: DaF-Unterricht, Humor, kulturelles Lernen, Jugendmedien, Kaya Yanar

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Einleitung

Im Zeitalter der Globalisierung ist interkulturelle Kompetenz für jeden Menschen unverzichtbar. Auch der Gemeinsame Europäische Referenzrahmen (GER) betont neben sprachlicher Handlungskompetenz ausdrücklich die Bedeutung von interkultureller Kompetenz und plurilingualem Bewusstsein (vgl. Europarat, 2020). Nach GER umfasst interkulturelle Kompetenz unter anderem (Europarat, 2001, S. 86):

- die Fähigkeit, die Ausgangskultur und die fremde Kultur miteinander in Beziehung zu setzen;
- kulturelle Sensibilität und die Fähigkeit, eine Reihe verschiedener Strategien für den Kontakt mit Angehörigen anderer Kulturen zu identifizieren und zu verwenden;
- die Fähigkeit, als kultureller Mittler zwischen der eigenen und der fremden Kultur zu agieren und wirksam mit interkulturellen Missverständnissen und Konfliktsituationen umzugehen;
- die Fähigkeit, stereotype Beziehungen zu überwinden.

Zur Förderung dieser Kompetenzen werden im DaF-Unterricht häufig Jugendliteratur, Serien, Filme, Musik, Comedy und Satire eingesetzt. Humor ist einer dieser Träger und beinhaltet Informationen über gesellschaftliche Abhandlungen und Abläufe (Hargaßner, 2020, S. 137-138). Sie spielt daher in der interkulturellen Kommunikation eine ambivalente Rolle, da sie neben Informationsvermittlung gleichzeitig dazu beiträgt, kulturelle Differenzen sichtbar zu machen, sie kritisch zu hinterfragen und gleichzeitig auf eine spielerische Weise Zugänge zu sensiblen Themen zu eröffnen. Aus diesen Gründen ist der Einsatz humoristischer Medien ein wichtiges pädagogisches Mittel, um sowohl sprachliche als auch interkulturelle Lernziele zu erreichen. Darüber hinaus ermöglicht sie eine Steigerung der Motivation und Aufmerksamkeit im DaF-Unterricht. Die positive Atmosphäre im Unterricht beeinflusst den Spracherwerb positiv (Kalkan & Erçoklu, 2020, S. 18).

Vor diesem Hintergrund wird im folgenden zunächst das Verhältnis von Sprache und Kultur erläutert. Daran anschließend werden die Konzepte Humor, schwarzer Humor und Satire sowie die für humoristische Kinder- und Jugendliteratur zentrale Doppeltadressiertheit und Doppelsinnigkeit dargestellt, um die Grundlage für die spätere Analyse der Jugendmedien und Comedy-Formate zu schaffen.

Sprache und Kultur

Eines der grundlegenden Instrumente für die Aufrechterhaltung des gesellschaftlichen Lebens ist die Sprache. Ihre wichtigste Eigenschaft besteht darin, ein unverzichtbares Mittel darzustellen, das die Kommunikation zwischen Menschen ermöglicht. Dass Individuen sowohl innerhalb ihrer eigenen Gesellschaft als auch mit Angehörigen anderer Kulturen miteinander kommunizieren, interagieren und gemeinsame Aktivitäten durchführen können, ist nur durch gegenseitiges Verständnis und das Vorhandensein einer gemeinsamen Sprache möglich. Fragt man nach der Funktion der Sprache, so lässt sie sich als fundamentales Mittel der Kommunikation und Interaktion definieren; bezieht man sich hingegen auf ihr Wesen oder ihren Ursprung, so lautet die Antwort: Kultur. Denn Sprache ist ein Produkt der Kultur. Eine Sprache, die von ihrem kulturellen Kontext losgelöst betrachtet wird, kann ihre eigentliche Funktion nicht erfüllen. Effektive Kommunikation ist nur dann möglich, wenn die Sprache in Verbindung mit ihrer kulturellen Dimension verwendet wird; andernfalls kommt es zu Störungen im Kommunikationsprozess und zu Schwierigkeiten bei der Zielerreichung (Günday & Aycan, 2018). Sprache ist nicht nur ein Kommunikationsmittel, sondern auch ein Träger von Werten. Ohne den kulturellen Bezug bleibt Kommunikation oberflächlich. Daher ist Kulturvermittlung im Sprachunterricht unverzichtbar.

Sprache ist nicht nur das grundlegende Mittel der Verständigung zwischen Menschen, sondern zugleich auch der bedeutendste Träger der Kultur. Deshalb können Sprache und Kultur nicht getrennt voneinander betrachtet werden; beide sind untrennbare Bestandteile der gesellschaftlichen Struktur. Während die Sprache die Kultur an die kommenden Generationen weitergibt, verleiht die Kultur der Sprache Sinn, Vielfalt und Orientierung. Gleichzeitig prägt die Gesellschaft mit ihren Werten und ihrer Lebensweise sowohl Sprache als auch Kultur. Dadurch entsteht eine ständige wechselseitige Interaktion zwischen Sprache, Kultur und Gesellschaft, die bei der Herausbildung der sozialen Identität eine

entscheidende Rolle spielt (Çekin & Çalışkan, 2020). Sprache prägt die kollektive Identität einer Gesellschaft. Sie verbindet Menschen durch gemeinsame Erinnerungen. Kultur gibt der Sprache Tiefe und Ausdruckskraft.

Nach Asutay (2003, S. 27) verfügt jede Sprache über eigene Zeichen und Symbole, die dazu dienen, die Realität der Außenwelt auszudrücken. Diese Symbole entwickeln sich innerhalb der jeweiligen kulturellen Strukturen der Gesellschaften. Folglich ist die Kultur das grundlegende Element, das der Sprache Bedeutung verleiht (Asutay, 2003).

Kultur wird als die Gesamtheit jener Elemente betrachtet, die im Alltag durch Erfahrung erworben werden und die die Lebensweise des Menschen prägen. Sprache ist ein Kommunikationsmittel, das nicht nur die Verständigung zwischen Menschen ermöglicht, sondern auch ein kulturelles Gewebe in sich trägt und seit der Existenz des Menschen vorhanden ist. Unter den Elementen, die die Kultur formen, nimmt die Sprache ohne Zweifel einen der zentralen Plätze ein. Seit Anbeginn der Menschheitsgeschichte hat die Sprache eine entscheidende Rolle für das Fortbestehen der Gesellschaften gespielt und war stets das wichtigste Mittel, Wissen, Erfahrungen und kulturelles Erbe an die kommenden Generationen weiterzugeben (Çekin & Çalışkan, 2020).

Kultur stellt eine vielschichtige Struktur dar, die die Sprache, die Glaubenssysteme, die Traditionen und Bräuche, die Verhaltensmuster sowie die Kunstauffassung einer Gesellschaft umfasst. Sie besteht aus Elementen, die von früheren Generationen überliefert wurden und von der Mehrheit der Gesellschaftsmitglieder als wertvoll angesehen werden. Kultur prägt die Denkweisen, Verhaltensweisen und sozialen Interaktionen der Individuen. Darüber hinaus ermöglicht sie es Gesellschaften, miteinander zu kommunizieren und Beziehungen aufzubauen. Jede Sprache enthält eine eigene Lebens- und Denkweise. Deshalb beinhaltet Sprachunterricht zugleich auch Kulturvermittlung (Alpar, 2013). Beim Erlernen einer Fremdsprache eignen wir uns nicht nur Wörter und Regeln an, sondern auch die kulturellen Elemente dieser Sprache. Sprache und Kultur sind ein untrennbares Ganzes, das sich gegenseitig ergänzt.

In einer sich ständig entwickelnden und verändernden Welt gewinnt das Konzept der „Interkulturalität“ zunehmend an Bedeutung. Multikulturelle Gesellschaften nutzen verschiedene Methoden und Techniken, um interkulturelle Kommunikationsfähigkeiten im Bildungssystem zu fördern. Besonders im Fremdsprachenunterricht wurde anfangs versucht, die Kulturvermittlung mit Hilfe unterschiedlicher Methoden umzusetzen; später trat die Entwicklung interkultureller Sprachkompetenzen in den Vordergrund. Bis heute ist Kultur sowohl in vielen Bereichen der Gesellschaft als auch in der Bildung wirksam. Vor allem im Fremdsprachenunterricht wird neben dem Erlernen einer anderen Sprache auch die Aneignung der entsprechenden Zielkultur vermittelt (Demirel, 2019). Interkulturalität fördert nicht nur sprachliche Kompetenz, sondern auch gegenseitiges Verständnis und Toleranz. Gerade im Fremdsprachenunterricht ermöglicht sie den Lernenden, andere Lebensweisen kritisch zu reflektieren.

Der Bedarf an Fremdsprachenkenntnissen ist heute aufgrund von Globalisierung, internationaler Vernetzung und digitaler Technologien deutlich gestiegen. Damit interkulturelle Kommunikation gelingen kann, muss neben der Sprache auch die zugehörige Kultur vermittelt werden. Authentische Materialien sowie multimediale Angebote unterstützen die Lernenden dabei, sprachliche und kulturelle Kontexte besser zu verstehen. In einer multikulturellen Welt ist zudem das Wissen um nonverbale Elemente wie Gestik und Mimik unverzichtbar. Kulturvermittlung gilt daher nicht als eigenständiges Ziel, sondern als notwendige Grundlage für den angemessenen und effektiven Gebrauch der Zielsprache. (Günday & Aycan, 2018).

In den im Fremdsprachenunterricht verwendeten Lehrbüchern wird meist nur ein begrenzter Ausschnitt der Zielkultur präsentiert, und die Beispiele verlieren mitunter an Aktualität. Deshalb sollten den Lernenden umfassendere Informationen vermittelt werden, die unterschiedliche Facetten der Zielkultur beleuchten (Köşker, 2015). Eine einseitige Darstellung der Zielkultur kann Stereotype verstärken. Durch aktuelle und vielfältige Beispiele erhalten Lernende ein differenzierteres Bild. So wird interkulturelles Lernen authentischer und nachhaltiger.

Ohne Kenntnis der Kultur ist es kaum möglich, eine Fremdsprache vollständig zu beherrschen. Deshalb sollte der Unterricht nicht nur Grammatik, sondern auch kulturelle Aspekte vermitteln. Sprache spiegelt

die Werte und Erfahrungen einer Gesellschaft wider, sodass ihre enge Verbindung mit Kultur im Fremdsprachenerwerb klar erkennbar wird. Im Sprachunterricht werden sprachliche und kulturelle Dimensionen der Zielsprache über die vier Grundfertigkeiten vermittelt. Um ihre Bedeutungswelt zu erfassen, ist auch die Kenntnis der kulturellen Struktur erforderlich. Fremdsprachenlernen geht über den Klassenraum hinaus und zielt darauf, dass Lernende die Zielsprache im eigenen Erfahrungsraum erleben (Zeyrek, 2020). Diese Sichtweise betont, dass Sprache ohne kulturelle Einbettung nur oberflächlich verstanden wird. Durch authentische Erfahrungen außerhalb des Klassenzimmers wird das Lernen nachhaltiger. So entwickeln die Lernenden sowohl sprachliche als auch interkulturelle Handlungskompetenzen.

Um eine Fremdsprache gut zu erlernen und interpretieren zu können, ist es wichtig, auch die zugehörige Kultur zu kennen. Das Ziel beim Erlernen einer Fremdsprache ist es daher, die Kultur dieser Sprache kennenzulernen und sich anzueignen. Die Untrennbarkeit von Sprache und Kultur verdeutlicht, dass die Kultur in den Fremdsprachenunterricht einbezogen werden muss. Da eine der zentralen Funktionen der Sprache darin besteht, Kultur zu vermitteln, ist es von besonderer Bedeutung, im Fremdsprachenunterricht soziale Verhaltensweisen, Literatur, Architektur, Ernährungsgewohnheiten und Handlungsmuster der Zielsprache zu vermitteln (Demirel, 2019).

Das Hauptziel des Fremdsprachenunterrichts sollte nicht nur in der Entwicklung sprachlicher Kompetenzen liegen, sondern ebenso in der Förderung interkultureller Kommunikationsfähigkeiten. Dieser Ansatz trägt dazu bei, dass die Lernenden sowohl im akademischen als auch im sozialen Leben zu bewussteren, sensibleren und handlungsfähigeren Individuen heranwachsen. Zudem können Missverständnisse, die aus kulturellen Unterschieden entstehen, vermieden und ein gesünderes sowie effektiveres Kommunikationsumfeld geschaffen werden.

Humor, Schwarzer Humor und Satire

Die Kinder- und Jugendliteratur (KJL) stellt laut Franz (1984, S. 103–104) ein breit gefächertes Medium dar, das traditionelle mündliche Erzählformen ebenso einbezieht wie moderne audiovisuelle und digitale Formate. Die mediale Vielfalt der KJL steht im Kontrast zum Social-Media-geprägten Rezeptionsverhalten Jugendlicher, das visuelle und fragmentierte Inhalte bevorzugt und komplexe Textstrukturen zunehmend verdrängt.

Viele Untersuchungen zeigen, dass die KJL in sprachlicher, emotionaler und interkultureller Hinsicht eine wichtige Bildungsfunktion erfüllt. Marquardt (vgl. 2004, S. 188) hebt hierbei vor allem das emotionale Potenzial von Filmen hervor. Ebenso tragen Sketche – sei es live auf der Bühne oder als audiovisuelle Darbietung – durch den Einsatz von Humor, schwarzem Humor und Satire zur Entwicklung von Empathie und Toleranz bei. Um die in Sketchen oft genutzten Techniken wie Satire, Humor und schwarzen Humor präzise zu definieren, ist ein Blick auf die historische Entwicklung dieser Begriffe sinnvoll.

Der Begriff „Humor“ stammt ursprünglich aus der antiken Humoralpathologie, einer Lehre über die vier Körpersäfte (Blut, Schleim, gelbe und schwarze Galle), die das Temperament und die Gesundheit eines Menschen bestimmen. Diese medizinische Theorie wurde während der „Goldenen Zeit des Islams“ – einer Periode vom 7. bis zum 14. Jahrhundert, in der Wissenschaft, Kultur und Bildung in der islamischen Welt florierten – insbesondere an den Medizinschulen weiterentwickelt und trug wesentlich zur Bewahrung und Weitergabe griechischen Wissens bei. Dort bildete die Humoraltheorie die Grundlage für das Verständnis von Krankheit und Therapie. Je nach vorherrschendem Körpersaft wurde ein bestimmtes Temperament (Mizaç) zugeordnet, das später auch individuelle Launen und Charakterzüge beschrieb (vgl. Hau, 1976, S.98; Sakin et al, 2017, S.33; Kardan, 2024, S.43).

Anlehnend an die medizinische Lehre der islamischen Welt entwickelte sich das Konzept des menschlichen Temperaments (Mizaç) zur Beschreibung individueller Launen und Charakterzüge. Im 16. Jahrhundert wurde der Begriff „Humor“ in England als „seltsame Laune“ oder „Charakterabweichung“ verstanden und fand Eingang in literarische sowie gesellschaftliche Ausdrucksformen. Somit vollzog sich ein historischer Wandel von „Humour“ vom körperlich-medizinischen Konzept hin zu einer psychologisch-sozialen Kategorie. Ausgangspunkt bildet die antike

Lehre der Körpersäfte („humours“), deren Ungleichgewicht sowohl körperliche als auch psychische Eigenheiten hervorrufen kann (Escarpit, 1969, S.253-254).

Der englische Dramatiker Ben Jonson aus dem 16. Jahrhundert, der als zentrale Figur der Humortheorie gilt, beschreibt „Humour“ als dominierende Eigenschaft, die das Verhalten prägt, und transformierte die Lehre der „humours“ literarisch zu einer Quelle individueller Charakterzüge und gesellschaftlicher Abweichungen (vgl. Cazamian, 1952). Escarpit (1969) betont, dass diese Theorie eine konsistente, wenn auch verzerrte Sicht der Realität darstellt, die erst im Gegensatz zur Norm als komisch wahrgenommen wird.

Harlow (vgl. 1969, S. 225) unterscheidet verschiedene Ausprägungen von Humor – von der brutalen bis zur intellektuell anspruchsvollen Form – und betont, dass Humor der Freisetzung von Aggressionen sowie der Entlastung sozialer Spannungen dient. Darüber hinaus erklärt er, dass Humor aus einem plötzlichen Triumphgefühl entsteht, das auf der Wahrnehmung eigener Überlegenheit gegenüber anderen basiert.

Die brutale Form des Humors zeigt sich besonders im Schwarzen Humor, der laut Röhrich (1977, S.142) gesellschaftliche Tabus wie Tod oder Angst thematisiert. Er führt aus, dass die Wirkung des schwarzen Humors in der Transformation des Entsetzlichen ins Komische besteht, wobei negative Affekte wie Ekel oder Schuld durch befreiendes Lachen abgeschwächt oder neutralisiert werden. Der schwarze Humor, so Röhrich (vgl. 1977, S.150), wird im Sinne des Surrealisten André Breton (1940) – der den Begriff “*humour noir/schwarzer Humor”* prägte und bekannt machte – als „Todfeind der Sentimentalität“ verstanden. Charakteristisch für den makabren Witz ist die paradoxe Verbindung widersprüchlicher Gefühle wie Angst und Komik. Obwohl die Zerstörung des Lebens selbst nicht als komisch gilt, erlaubt der schwarze Humor dem Menschen dennoch, dem Tod mit einem Lächeln zu begegnen.

Im Gegensatz zum schwarzen Humor verfolgt die Satire eine gezielte kritische Absicht, indem sie humorvolle Mittel nutzt, um auf gesellschaftliche und politische Missstände aufmerksam zu machen. Ihre Effektivität beruht dabei wesentlich auf der stilistischen Ausgestaltung, die innerhalb der Toleranzgrenzen des Publikums bleiben muss. Ihre volle Wirkung entfaltet die Satire insbesondere dann, wenn sie bestehende soziale, institutionelle oder ideologische Strukturen mit normativen Leitbildern kontrastiert und dadurch deren Schwächen offenlegt.

Baypınar (vgl. 1978, S.31-33), der neben seinen Arbeiten zur Migrationsliteratur auch Beiträge zur Satireforschung – etwa in seiner Studie *„Hiciv kavramı üzerine bir inceleme“* – vorgelegt hat, unterstreicht, dass eine angemessene Begriffsbestimmung der Satire nur unter Berücksichtigung ihrer historischen Genese möglich ist. Er vergleicht Satire mit einem feinfühligen Instrument, das gesellschaftliche Zustände widerspiegelt und auf soziale Verwerfungen reagiert. In etymologischer Hinsicht verweist Baypınar, in Anlehnung an Weinrich (vgl. 1962, S.287), auf das lateinische *satura* – im Sinne eines „bunten Gemischs“ oder einer „vielfältigen Schüssel“ – . Baypınar charakterisiert die satirische Darstellung als einen literarischen Angriff, bei dem ein Individuum oder Objekt dem Spott des Publikums ausgeliefert wird, sodass es durch die Sprache symbolisch „vernichtet“ wird. Satire, so Baypınar, ist ein verbaler Schlagabtausch – ein sprachlicher Kampf, dessen Ziel es ist, Missstände sichtbar zu machen und die Rezipienten zum Nachdenken oder Handeln anzuregen.

Für Tucholsky (vgl. 1964, S.12) besteht der Erfolg der Satire darin, ihre kritische Botschaft so zu formulieren, dass sie nicht die Toleranzgrenze des Rezipienten überschreitet. Der Satiriker selbst wird von ihm als enttäuschter Idealist verstanden, dessen Ziel es ist, die Missstände der Welt zu bekämpfen und auf Veränderung hinzuwirken.

Zusammenfassend lässt sich sagen, dass Satire eine literarische Ausdrucksform ist, die primär eine kritische Funktion erfüllt. Sie thematisiert gesellschaftliche Missstände, indem sie diese durch den Kontrast zu einem idealisierten Zustand sichtbar macht. Der Einsatz von Humor dient dabei nicht der bloßen Unterhaltung, sondern verstärkt die zugrunde liegende Kritik. Verliert die Satire jedoch ihren kritischen Anspruch, büßt sie ihre gesellschaftliche Relevanz ein.

Doppeltadressiertheit und Doppelsinnigkeit

Ein vertiefender Blick auf Humor, insbesondere schwarzen Humor und Satire, als literarische Techniken in KJL-Texten und Sketchen zeigt, dass diese häufig mehrdeutige Botschaften transportieren, deren vollständiges Verständnis besondere interpretatorische Fähigkeiten voraussetzt. Da sich die satirischen und doppelsinnigen Aussagen eines Sketches nicht immer unmittelbar erschließen, kommt dem Vermittler die zentrale Aufgabe zu, den Reflexionsprozess anzuleiten. Dies ist insbesondere für Kinder und Jugendliche von großer Bedeutung, da sie sich noch in der Entwicklung ihrer literarischen und medialen Kompetenz befinden. Um die intendierten Botschaften solcher Werke angemessen zu erfassen, muss die spezifische Art der Adressierung berücksichtigt werden – denn sie beinhalten Aussagen, die sowohl sprachlich als auch inhaltlich interpretiert werden müssen

Ewers betont, dass Kinderliteratur immer auch die Erwartungen der erwachsenen Mitleser berücksichtigen muss, da diese eine wichtige Vermittlerrolle einnehmen. Er unterscheidet klar zwischen Doppeltadressiertheit und Doppelsinnigkeit in der Kinder- und Jugendliteratur. Während diese Begriffe oft synonym verwendet werden, liegt der Unterschied laut ihm in der Rolle des erwachsenen Lesers. Bei der Doppeltadressiertheit richtet sich die Literatur ausdrücklich an zwei Gruppen: Kinder als Hauptleser und Erwachsene (Eltern, Pädagogen), die als Vermittler fungieren und oft gemeinsam mit den Kindern lesen. Diese doppelte Ansprache ist strukturell in die Kommunikation eingebaut, da Erwachsene die Bücher auswählen und den Rezeptionsprozess begleiten. Doppelsinnigkeit hingegen beschreibt eine literarische Qualität, bei der ein Werk zwei Bedeutungsebenen eröffnet: eine oberflächliche für Kinder und eine tiefere, implizite für Erwachsene. Hier sind Erwachsene zwar nicht direkt angesprochen, verstehen aber eine verborgene Botschaft. Diese Mehrfachadressierung kann auch explizit werden, etwa wenn ein Buch gleichzeitig für Kinder und Erwachsene veröffentlicht wird. So bietet Doppelsinnigkeit einen erweiterten Interpretationsspielraum (vgl. Ewers, 2000, S:103-125).

> „Die Kinderliteratur ist nämlich nur auf den ersten Blick durch eine solche Einfachadressierung gekennzeichnet; bei genauerem Hinsehen deckt sich eine relativ komplizierte Mehrfachadressierung auf. Neben dem offiziellen kennt die Kinderliteratur durchaus einen mitlesenden Erwachsenen, der eine wie auch immer geartete Vermittlerfunktion ausübt. Hierbei kann es sich um Eltern und Erzieher, um Kindergärtnerinnen, Lehrer, Buchhändler, Bibliothekare, um Literaturkritiker und Pädagogen handeln. Ein kinder-literarischer Text hat neben den Erwartungen der kindlichen Leser stets auch die der erwachsenen Mitleser zu erfüllen.“ (Ewers, 1990, S.17)

Gerade im Kontext satirischer Sketche spielt die Mehrdeutigkeit eine zentrale Rolle, da sie es ermöglicht, komplexe gesellschaftliche Themen auf zugängliche, aber zugleich tiefgründige Weise zu thematisieren. Sketche wie die von Kaya Yanar zeigen, wie humoristische Mittel gezielt zur kritischen Auseinandersetzung mit sozialen Strukturen eingesetzt werden können.

Literaturüberblick

In diesem Teil der Arbeit werden Publikationen zum Thema ‚Humor‘ vorgestellt, die sich in zwei eng miteinander verknüpfte Bereiche einteilen lassen. Zum einen werden Arbeiten präsentiert, die Humor als Medium interkultureller Aushandlung im deutsch-türkischen Kontext analysieren, insbesondere in Ethno-Comedy, Literatur und Film. Zum anderen werden Arbeiten vorgestellt, die Humor als didaktisches Werkzeug im Fremdsprachenunterricht untersuchen. Die Auswahl dieser beiden Forschungsperspektiven orientiert sich an der Fragestellung der Arbeit, da Humor sowohl in seiner gesellschaftlich-kulturellen Dimension als auch in seiner didaktischen Funktionalität untersucht werden soll.

Im Bereich der interkulturellen Aushandlung liegt ein Schwerpunkt auf Ethno-Comedy und Comedy. Doynova (2010) analysiert *Türkisch für Anfänger* als Ethno-Comedy und untersucht das Integrations- und Sozialisierungspotenzial dieses Formats. Bower (2011) befasst sich mit Serdar Somuncu im Kontext ethnokultureller Comedy, Koch (2008) thematisiert allgemein die Ethno-Comedy in Deutschland. Turan (2013) untersucht *Was guckst du?!* von Kaya Yanar aus sprach- und kulturwissenschaftlicher Sicht. Kotthoff (2011) zeigt die Rolle von Ethno-Comedy und riskantem Humor in jugendlichen Cliquen. Bower (2014) analysiert Kaya Yanar und Bülent Ceylan als Inszenierung von Integration. Höllering (2016) betont die kulturpolitische Funktion türkisch-deutscher Ethno-Comedy. Ein weiterer thematischer Bereich betrifft Film und Serien. Göktürk (2003) diskutiert Exil, Diaspora und kulturelle

Hybridität im transnationalen Kino. Gabriel (2018) untersucht deutschtürkische Filmkomödien und Zambon (2017) analysiert transkulturelle Comedy-Serien wie *Türkisch für Anfänger* und *Alle lieben Jimmy*. Specht (2011) zeigt, wie Humor hybride Identitäten sichtbar macht und Kulturvorstellungen irritiert. Insgesamt verdeutlichen diese Studien, dass humoristische Formate zentrale Orte der Aushandlung von Zugehörigkeit, Differenz und Hybridität sind. Gleichzeitig werden sie jedoch selten systematisch als Dokumente ausgewertet, deren innere Bedeutungsstrukturen gezielt für didaktsiche Zwecke im DaF-Unterricht erschlossen werden.

Im Bereich Humor als didaktisches Werkzeug zeigen Godsall-Myers und Wienroeder-Skinner (2005) anhand der Filme *Good Bye Lenin!* und *Sonnenallee*, wie humorvolle Szenen im DaF-Unterricht eingesetzt werden können. Feld-Knapp (2007) untersucht humorvolle Texte am Beispiel von Kishons Erzählung *Sex* und entwickelt methodische Vorschläge. Utri (2012) zeigt am Beispiel von Musikerwitzen, wie kulturelle Unterschiede reflektiert werden können. Mášková (2016) analysiert die Textsorte Witz und deren Einsatz auf allen GER-Niveaustufen. Poniridou (2024) untersucht Witze ebenfalls als spezifische Textsorte. Üstün und Ağaçsapan (2021) entwickeln konkrete Didaktisierungsvorschläge. Ağaçsapan et al. (2018) befassen sich mit ethnischen Witzen als Mittel interkultureller Vermittlung, Middeke und Murdsheva (2008) mit Nationen- und Ethnowitzen und Pawlowska-Balcerska (2022) mit interkulturellen Witzen als Träger nationaler Stereotype. Ein weiterer Schwerpunkt liegt auf humoristischen Elementen in Lehrwerken. Kalkan und Erçoklu (2020) analysieren *Studio d*, Çıldır und Koçak (2022) *Schritte International*, Sotiropoulou (2022) Lehrwerke auf C1/C2-Niveau und Jakosz (2024) untersucht den Stellenwert von Humor in Lehrplänen und Curricula. Darüber hinaus untersucht Belyaev (2022) die pragmatische Funktion von Humor im deutsch-russischen Kontext, Kuhn (2024) den gezielten Einsatz von Humor im Primarschulunterricht und Hohenhaus (2000) den Einsatz humoristischen Materials in Phraseologie und Sprachspiel zur Förderung von Lernmotivation.

Die genannten Arbeiten zeigen, dass Humor in Unterricht vor allem motivationale, interkulturelle und reflexive Potenziale besitzt. Zugleich wird jedoch deutlich, dass viele Beiträge eher konzeptionell argumentieren und weniger auf einer systematischen Auswertung konkreter Dokumente, insbesondere aktueller Jugendmedien und Comedy-Formate, beruhen. Eine engere Verknüpfung von inhaltsanalytischer Betrachtung humoristischer Materialien und darauf aufbauender didaktischer Konzeption, speziell für die Niveaustufen B1/B2, ist bislang nur ansatzweise erkennbar.

Vor diesem Hintergrund setzt die vorliegende Studie an der Schnittstelle beider Forschungsstränge an. Humor wird sowohl als Medium interkultureller Identitätskonstruktion als auch als didaktisches Werkzeug verstanden. Durch die Analyse der Trendshow *Made in Germany* sollen Muster der Darstellung von Erziehungswerten und Stereotypen rekonstruktiert und im Hinblick auf ihr Potenzial für kulturelles Lernen im DaF-Unterricht erschlossen werden.

Methode

Die Durchführung der vorliegenden Untersuchung erfolgt auf Basis einer qualitativen Forschungsmethode, die sich an der Dokumentenanalyse orientiert. Laut Döring (2015) wird unter einer wissenschaftlichen Dokumentenanalyse als Datenerhebungsmethode eine zielgerechte, systematische und regelgeleitete Sammlung und Archivierung von vorhandenen Dokumenten als Gestaltung menschlichen Erlebens und Verhaltens verstanden. Dabei kann es sich inhaltlich um persönliche oder offizielle Dokumente sowie formal um textuelle/verbal-schriftliche sowie um nicht-textuelle (visuelle, auditive, audiovisuelle, multimediale, hypermediale etc.) Dokumente handeln. Diese Methode ermöglicht, audiovisuelle und textbasierte Materialien – im konkreten Fall humoristische Darstellungen in Jugendmedien sowie die ausgewählte Folge der Trendshow *Made in Germany* von Kaya Yanar – systematisch auszuwerten. Die methodische Herangehensweise erfolgt im Sinne einer kausal-nicht-experimentellen Untersuchung, wobei bestehende Darstellungen wie interkulturelle Erziehungsstile und Stereotypen beobachtet, beschrieben und in Bezug auf kulturelle Identitätskonstruktionen im Rahmen eines kontrastiven Vergleichs auf ihre Relevanz für den DaF-Unterricht hin überprüft und interpretiert werden. Dadurch lassen sich Muster und Bedeutungsstrukturen sichtbar machen, die für die Entwicklung didaktischer Ansätze auf den Niveaustufen B1/B2 nutzbar sind. Ziel ist es, aufzuzeigen,

wie Humor als Medium kulturellen Lernens eingesetzt werden kann und welche Potenziale die kontrastive Aufarbeitung von Erziehungswerten für den fremdsprachlichen Deutschunterricht bietet.

Analyse und Diskussionen

Die Comedy-Show *Was guckst du?!* wurde ab Mai 2001 auf Sat.1 ausgestrahlt und machte Kaya Yanar einem breiten Fernsehpublikum bekannt. Im Zentrum der Sendung standen interkulturelle Sketche, in denen Yanar unterschiedliche stereotype Figuren verkörperte, um gängige Vorurteile auf humoristische Weise zu dekonstruieren. Die Popularität des Formats spiegelte sich nicht nur in hohen Einschaltquoten wider, sondern auch in zahlreichen Auszeichnungen, darunter der Deutsche Comedypreis sowie der Deutsche Fernsehpreis in der Kategorie „Beste Comedy“

Einer der Sketche aus der Comedy-Show, „*Kai Uwe, wir müssen miteinander reden“,* veranschaulicht exemplarisch die Vielzahl kulturbezogener und vergleichender Satiren, die sowohl in der Sammlung *Made in Germany* als auch in *Was guckst du?!* zentrale gesellschaftliche Themen aufgreifen. In satirisch zugespitzter Form werden hier Fragen der Erziehung, Sprache, Schulbildung, Körperbilder, Ernährungsweisen, des Rechtsverständnisses oder der Feiertagskultur behandelt. Die wiederkehrenden Figuren Hakan, Ranjid und Francesco zeigen, wie Kaya Yanar stereotype Repräsentationen kultureller Identitäten mit differenzierten Einblicken in deutsche und migrantische Lebensrealitäten kombiniert. Die humorvolle Übertreibung ermöglicht dabei eine kritische Auseinandersetzung mit interkulturellen Spannungsfeldern, etwa mit fremdenfeindlichen Einstellungen oder kulturellen Missverständnissen. Zugleich rücken auch Unterschiede in Erziehungsvorstellungen in den Fokus. So verdeutlicht der Sketch „*Kai Uwe, wir müssen miteinander reden*“ besonders anschaulich den Kontrast zwischen autoritären und dialogorientierten Erziehungsstilen in deutschen und türkischen Familienmodellen.



Der Sketch wurde für die Analyse transkribiert und in einzelne Szenen mit Zeitstempeln gegliedert. Zudem erfolgte eine freie Übersetzung ins Englische, die als Untertitel in das Videomaterial integriert wurde.



Szene (1)

00:00–00:22 – Punkt 7 Uhr mussten alle Kinder zu Hause sein..



Szene (2)

00:27–00:33 egal, ob türkisch, deutsch, italienisch … „Punkt 7 Uhr zu Hause, da wird Abend gegessen!“ ..die Deutschen auch – Punkt 7...



Szene (3)

00:49–00:54 Die türkische Mama kam, die arabische Mutter, die italienische Mutter, meine Mutter kam auch. Ach, meine Mama ist diebeste Mama der Welt.



Szene (4)

01:18–01:20 – Halb acht – da wurde es ernst. Da kamen nämlich die Väter!, Alle Väter kamen: der türkische Papa, der arabische Papa, der italienische Papa, der deutsche Vater.



Szene (5)

01:48–02:20 – Und du hast alle Kulturen auf einmal gehört: Der arabische Vater, der türkische Vater, der chinesische Vater, der holländische Vater, der indische Vater. Oh, der war süß, der indische Vater.



Szene (6)

02:27–02:45 Ranjit: „Erkan! Kaya! Guck mal da! Da kommt euer Papa gleich! Gleich kriegt ihr Kloppe! La la la!“



Szene (7)

02:40–02:50 – Die Kinder: „Naaaaaah!“ Und die Väter: „Aaaaaah!“ Der italienische Vater auch:„Porca Madonna! Porca miseria!“ Es war ein Riesentohuwabohu!



Szene (8)

02:51–03:08 Nur der deutsche Vater – der hat sich nicht bewegt. Riesenunterschied zu den anderen Vätern. Er blieb einfach stehen.Stand da an der Startlinie, bewegte sich nicht, war total cool. Er stand einfach nur da und sagte einen Satz:



Szene (9)

03:08–03:17 – Kai Uwe... Kai Uwe, komm mal her.“ „Nein, ich renn dir nicht hinterher. Du kommst jetzt hierher



Szene (10)

03:18–03:29 Und dann kam dieser Satz, den ich bis heute nie vergessen werde: Dieser Satz ist deutsch. Made in Germany. Er ist einfach deutsch.



Szene (11)

03:29–03:29 – Kai Uwe...



Szene (12)

03:29–03:29 „wir müssen miteinander reden.“

Abb. 1. Der Sketch „ *Kai Uwe, wir müssen miteinander reden*!“

Die Analyse der Szenen verdeutlicht eine klare dramaturgische Entwicklung: Sie beginnt mit universalen Kindheitserfahrungen wie festen Essenszeiten und mütterlicher Fürsorge, führt über die satirisch überzeichnete Darstellung kulturell geprägter Väterrollen („Babakultur“ und Väterstereotype) und kulminiert schließlich im kontrastiven Leitmotiv *„Kai Uwe, wir müssen miteinander reden“*. Kaya Yanar verbindet dabei Stereotypisierung und Satire auf eine Weise, die kulturelle Unterschiede nicht

nur sichtbar macht, sondern zugleich als Gegenstand kritischer Reflexion und interkultureller Aushandlung präsentiert.

Szene (1) – 00:00–00:22	Die feste Uhrzeit „Punkt 7“ etabliert ein universales Kindheitserlebnis und schafft die gemeinsame Ausgangsbasis für kulturelle Vergleiche.
Szene (2) – 00:27–00:33	Durch die Aufzählung verschiedener Nationalitäten wird Gleichheit betont und Humor aus der kulturellen Gemeinsamkeit erzeugt.
Szene (3) – 00:49–00:54	Die Mütter erscheinen fürsorglich und mahnend, wodurch eine universale „Mütterkultur“ sichtbar wird.
Szene (4) – 01:18–01:20	Mit dem Auftritt der Väter verschiebt sich der Ton ins Strenge, wodurch „Babakultur“ als Symbol von Autorität eingeführt wird.
Szene (5) – 01:48–02:20	Die Väter werden stereotyp überzeichnet, wodurch kulturelle Unterschiede komisch hervorgehoben und zugleich verallgemeinert werden.
Szene (6) – 02:27–02:45	Kindliche Angst vor Strafe wird humoristisch übertrieben, um die Autorität der Väter satirisch zu brechen.
Szene (7) – 02:40–02:50	Sprachliche Eigenheiten der Väter erzeugen ein polyphones Chaos, das Stereotype akustisch sichtbar macht.
Szene (8) – 02:51–03:08	Der deutsche Vater wird durch seine Ruhe kontrastiv herausgestellt, wodurch die Pointe vorbereitet wird.
Szene (9) – 03:08–03:17	Sprachliche Autorität ersetzt körperliche Gewalt und markiert den „typisch deutschen“ Erziehungsstil.
Szene (10) – 03:18–03:29	Mit „Made in Germany“ wird der Erziehungsstil ironisch als kulturelles Markenzeichen deklariert.
Szene (11) – 03:29	Der Name „Kai Uwe“ fungiert als Symbol für deutsche Kindheit und fixiert das Stereotyp.
Szene (12) – 03:29	Der Satz „wir müssen miteinander reden“ wird zum Leitmotiv, das Dialog als deutsche Erziehungsnorm kodiert.

Der Sketch „Kai Uwe, wir müssen miteinander reden“ stellt in exemplarischer Weise dar, wie Kaya Yanar kulturelle Unterschiede in familiären Erziehungspraktiken humoristisch zuspitzt und zugleich kritisch reflektiert. Ausgangspunkt ist die universelle Kindheitserfahrung, zu einer bestimmten Zeit nach Hause gerufen zu werden, um gemeinsam mit der Familie zu essen. Diese Erfahrung wird zunächst in einer übersteigerten Form als gemeinsames Muster dargestellt: unabhängig von Herkunft oder Kultur bestehen die Eltern auf festen Regeln – „Punkt 7 Uhr zu Hause“. Yanar konstruiert dadurch eine gemeinsame Basis, die das Publikum – gleich welcher Herkunft – wiedererkennen und mitlachen lässt.

Die zentrale Pointe entsteht jedoch in der kontrastiven Darstellung der väterlichen Figuren. Während die Väter aus verschiedenen migrantischen Kontexten in einer übertrieben körperlich-autoritären Weise agieren – inszeniert wie in einem Westernfilm, lautstark, aggressiv und in einem Wettbewerb der Durchsetzungsfähigkeit –, wird der „deutsche Vater“ durch eine ruhige, fast stoische Haltung markiert. Statt mit physischem Druck zu arbeiten, setzt er auf sprachliche Autorität: „Kai Uwe, wir müssen miteinander reden.“ Diese scharfe Gegenüberstellung erzeugt komische Effekte, zugleich verweist sie auf stereotype Zuschreibungen kultureller Erziehungsstile: migrantische Familien als streng, laut und körperorientiert, deutsche Familien dagegen als rational, dialogisch und sprachzentriert.

Die Übertreibung und die performative Ausgestaltung – inklusive parodistischer Nachahmung von Akzenten, Gesten und Tonlagen – dient hier als satirisches Mittel, das die Unterschiede überspitzt, ohne sie gänzlich zu diskreditieren. Vielmehr eröffnet sich eine doppelte Lesart: Einerseits wird das Publikum zum Lachen gebracht, andererseits werden kulturell geprägte Vorstellungen von Autorität, Kommunikation und Kindheit in Frage gestellt. Besonders bemerkenswert ist, dass Yanar die Darstellung nicht in einer binären Gegenüberstellung von „deutsch“ versus „fremd“ belässt, sondern ein

kaleidoskopartiges Panorama verschiedener kultureller Hintergründe entwirft (türkisch, arabisch, italienisch, indisch, etc.). Dadurch entsteht ein polyphones Bild von Erziehungsrealitäten, in dem Gemeinsamkeiten und Unterschiede zugleich sichtbar werden.

Schlussbemerkung

Der Sketch „*Kai Uwe, wir müssen miteinander reden*“ zeigt, wie Humor kulturell geprägte Erziehungsvorstellungen pointiert sichtbar macht und dabei sowohl Gemeinsamkeiten als auch Unterschiede hervorhebt. Besonders die Darstellung der Vaterfiguren verdeutlicht, wie stark kulturelle Erziehungspraktiken durch stereotype Muster geprägt sind: Während migrantische Väter in überzeichneter Form als laut, körperlich präsent und autoritär erscheinen, verkörpert der „deutsche Vater“ mit seiner sprachlich-nüchternen Autorität ein kontrastives Erziehungsideal. Auf diese Weise wird eine „Babakultur“ inszeniert, die einerseits stereotype Zuschreibungen reproduziert, andererseits aber auch deren komische Übertreibung und damit kritische Reflexion ermöglicht.

Für den DaF-Unterricht bietet der Sketch ein hohes didaktisches Potenzial. Lernende können anhand der Darstellung von Vaterfiguren nicht nur sprachliche Strukturen aufnehmen, sondern auch stereotype Bilder hinterfragen und interkulturelle Unterschiede in familiären Rollenmustern reflektieren. Humor fungiert hier als didaktisches Medium, das kulturelle Codes spielerisch entlarvt und zugleich den Zugang zu komplexen Themen wie Elternrollen, Autorität und Kommunikation erleichtert.

Im Kontext der Kulturvermittlung im DaF-Unterricht kann dieser Sketch Lernenden ab B1/B2-Niveau helfen, Sensibilität für die Vielfalt elterlicher Erziehungsmuster zu entwickeln. Die Auseinandersetzung mit „Babakultur“ und Stereotypen zeigt, dass kulturelle Unterschiede nicht als Barrieren, sondern als Ressourcen für Reflexion, Dialog und gemeinsames Verstehen genutzt werden können.

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Data Availability Statement: If the data is accessible, authors should specify where it can be found and provide the relevant link (e.g., in a public repository or as supplementary material). If the data is not publicly available, authors should explain how researchers can request access to the study's data. In cases where data sharing is not possible due to confidentiality, ethical restrictions, or other limitations, authors should clearly state the reason and provide a detailed explanation

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A Study on the Relationship Between Artificial Intelligence Literacy and Heutagogical Skills of Pre-service Turkish Language Teachers

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Abstract

The purpose of this study is to examine the relationship between Turkish language teacher candidates' levels of Artificial Intelligence (AI) literacy and their heutagogical (self-determined) learning competencies. The teacher profile required in the digital age extends beyond pedagogical proficiency and encompasses the ability to manage one's own learning as well as to use emerging technologies effectively. In this context, heutagogy involves individuals' capacity to plan, implement, and evaluate their own learning processes and to engage in lifelong learning, while AI literacy requires understanding AI systems and using these technologies ethically and consciously. Both domains are associated with learner autonomy, critical thinking, and the ability to adapt to rapidly evolving digital environments. This study explores the relationship between AI literacy and heutagogical competencies—two key qualifications expected of teacher candidates in the era of digital transformation. To investigate the nature, degree, and direction of the relationship between these variables, the research employed the correlational survey model, a quantitative research design commonly used to examine relationships among multiple variables. Through this model, the current status of these competencies among teacher candidates was identified, and the extent of their interrelation was evaluated. The study group consisted of 166 Turkish language teacher candidates enrolled in faculties of education during the 2025–2026 academic year. Data were collected using the Self-Determined Learning (Heutagogy) Competency Scale and the Artificial Intelligence Literacy Scale, and were analyzed through correlation techniques. The findings reveal that the participants perceive themselves as competent in both AI literacy and heutagogical learning, although certain subdimensions require further development. Additionally, gender was found not to significantly influence these competencies, and a positive, moderate relationship was identified between AI literacy and heutagogical learning. These results underscore the necessity of integrating both technological and autonomous learning skills into teacher education programs in the digital era.

Keywords: Artificial intelligence literacy, heutagogical skills, pre-service Turkish language teachers,teacher education, digital transformation

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Introduction

This study aims to examine the relationship between Turkish language teacher candidates' Artificial Intelligence (AI) literacy and their heutagogical learning competencies. As digital technologies increasingly permeate teaching and learning environments, the expectations placed on teachers have expanded beyond traditional instructional roles. Contemporary educators are now required to demonstrate not only strong pedagogical foundations but also the ability to critically engage with technological tools, interpret digital data, and integrate innovative applications into their instructional practices. AI-related technologies, in particular, have begun to influence curriculum design, assessment processes, personalized learning systems, and administrative decision-making in educational institutions. Consequently, developing AI literacy has become essential for teachers who must navigate these tools responsibly, understand their underlying mechanisms, and make informed judgments about their pedagogical implications, limitations, and ethical considerations

In parallel with technological advancements, heutagogy has gained prominence as an approach that emphasizes autonomy, self-regulation, and learner agency in educational contexts. For prospective teachers, heutagogical competencies are especially significant, as they not only support individual professional growth but also shape their capacity to design learning environments that foster similar autonomy in their future students. The increasing complexity and dynamism of digital learning ecosystems require teachers to become adaptable, reflective, and proactive learners who can continuously update their knowledge and skills. Therefore, examining the interplay between AI literacy and heutagogical learning competencies is crucial for understanding how these two domains jointly contribute to the formation of the contemporary teacher profile. In this study, teacher candidates' competency levels in these areas, their perceptions regarding associated subdimensions, and possible gender-based variations are analyzed comprehensively to provide a more holistic understanding of the competencies required for effective teaching in the digital age.

Literature Review

The heutagogical approach is a contemporary learning paradigm that emphasizes full learner autonomy and the ability of individuals to design their own learning journeys (Sarkın & Seçkin, 2023). Heutagogical learning encompasses individuals' abilities to plan, manage, and evaluate their learning processes. Recent research further advances this approach by presenting a paradigm in which responsibility for learning resides entirely with the learner and learning capability assumes a central role. Heutagogical learning skills can be developed through instructional processes (Güven & Babayiğit, 2020) and have a decisive impact on academic achievement and lifelong learning tendencies. For example, Güven and Babayiğit (2020) found that undergraduate students' heutagogical learning skills were at a moderate level and that educational programs did not sufficiently support these competencies. Similarly, Kaya (2021) reported significant relationships between teacher candidates' lifelong learning tendencies and self-regulated learning beliefs, while demographic variables such as gender and economic status did not play a determining role in these relationships.

The idea that heutagogical learning competencies can be enhanced is supported by numerous studies. Öz and Şen (2021) demonstrated that instructional activities based on self-regulated learning positively influenced students' lifelong learning, self-regulation, and critical thinking tendencies, highlighting that heutagogy fosters sustainable learning behaviors. Likewise, Orak and Sarıtepeci (2019) identified self-directed learning as one of the strongest predictors of teacher candidates' lifelong learning tendencies. The study by Şenel and Badak (2022) emphasized the significant relationship between English teacher candidates' attitudes toward autonomous learning and their lifelong learning tendencies, showing that autonomous learners can determine their own learning goals independently of time and place.

With the acceleration of digital transformation, AI literacy has emerged as a multidimensional competency that complements contemporary learning approaches and requires individuals to use technology consciously and critically. Yılmaz and Yılmaz (2023) define AI literacy as a comprehensive construct encompassing the knowledge, skills, and attitudes individuals need to understand, evaluate, and effectively use AI technologies. Examining research trends in Türkiye, Aydın (2024) notes rapid

growth in technical areas such as machine learning, deep learning, and neural networks, while also identifying considerable gaps in social science applications of AI and in topics such as AI ethics. Accordingly, Erdoğdu and Çakır (2024) emphasize the need for educational programs to be enriched with comprehensive and multidisciplinary content in order to develop individuals' AI literacy. Taken together, these studies demonstrate that both heutagogy and AI literacy serve as complementary competencies that deepen learning experiences, strengthen learner autonomy, and enhance adaptation to the demands of the digital age.

Drawing on this body of literature, the present study investigates the nature of the relationship between Turkish language teacher candidates' AI literacy and their heutagogical learning competencies, thereby revealing the extent to which these two contemporary competencies are interconnected.

In line with this purpose, the study seeks to answer the following research questions:

1. Do Turkish language teacher candidates' heutagogical learning competencies and AI literacy levels differ significantly by gender?
2. What are teacher candidates' perceptions regarding the subdimensions of heutagogical learning and AI literacy?
3. Is there a relationship between Turkish language teacher candidates' heutagogical learning competencies and their AI literacy levels?

Method

Research Design

This study was conducted using a correlational survey design, which is one of the quantitative research methods. The correlational survey model enables a detailed and comprehensive examination of the relationships among variables (Tatoğlu & İçen, 2019). Within the scope of the study, it was investigated whether there were significant differences between the gender variable, which served as the independent variable, and the dependent variables of AI literacy levels and heutagogical learning competency levels among teacher candidates. In addition, the relationship between AI literacy and heutagogical competencies was tested, and statistical analyses were conducted to determine the strength and direction of this relationship.

Study Group

The study was carried out with data collected from 166 Turkish language teacher candidates enrolled in the faculty of education at a university in Türkiye during the 2025–2026 academic year. Information regarding the participants is presented in Table 1.

Table 1.

Distribution of Participants According to Demographic Characteristics

Variable	Category	f	%
Gender	Male	130	78.3
	Female	36	21.7
	Total	166	100
Year of Study	1st Year	19	11.4
	2nd Year	29	23.5
	3rd Year	53	31.9
	4th Year	65	33.2
	Total	166	100

An examination of the data in Table 1 shows that 78% of the participants were female and 21% were male.

Data Collection

For data collection, the Heutagogical (Self-Determined) Learning Competency Scale and the Artificial Intelligence Literacy Scale were transferred to Microsoft Forms. Data were obtained from Turkish language teacher candidates who voluntarily agreed to participate in the study.

Data Collection Instruments

Heutagogical (Self-Determined) Learning Competency Scale

The Heutagogical (Self-Determined) Learning Competency Scale was developed by Sarkın and Seçkin (2023) to determine university students' self-determined learning skills. The validity and reliability studies of the scale were conducted with the participation of 574 university students. Based on the data collected from 352 participants, an Exploratory Factor Analysis (EFA) revealed a four-factor structure explaining 42.17% of the total variance: Learning to Learn (eigenvalue = 4.38; variance explained = 19.9%), Learner Autonomy (eigenvalue = 2.18; variance explained = 9.93%), Self-Motivation (eigenvalue = 1.47; variance explained = 6.66%), and Self-Management (eigenvalue = 1.25; variance explained = 5.68%). The 22-item scale includes seven items in the first factor with loadings ranging from 0.544 to 0.648, seven items in the second factor with loadings between 0.439 and 0.666, four items in the third factor with loadings between 0.521 and 0.734, and four items in the fourth factor with loadings between 0.508 and 0.722. Confirmatory Factor Analysis (CFA), conducted on a separate sample of 222 participants, indicated acceptable model fit indices (AGFI = .87, GFI = .92, NNFI = .92, CFI = .94, IFI = .94), confirming the scale's factor structure. Reliability analyses demonstrated satisfactory internal consistency, with Cronbach's alpha coefficients of .82 for the Learning to Learn subscale, .76 for Learner Autonomy, .86 for Self-Motivation, .84 for Self-Management, and .86 for the overall scale. Split-half reliability coefficients were calculated as .74, .72, .78, .73, and .80 respectively for the same subscales and the total score. The final version of the scale consists of 22 items—15 positively worded and seven negatively worded (items 2, 6, 8, 10, 13, 15, 17). It uses a five-point Likert-type rating scale ranging from "never (1)" to "always (5)." Positive items are scored from 1 to 5, while negative items are reverse scored. Scale scores range from 22 to 110, with higher scores indicating stronger self-determined learning competencies.

Artificial Intelligence Literacy Scale

The Artificial Intelligence Literacy Scale was adapted into Turkish by Erdoğan and Ekşioğlu (2024) to measure teachers' levels of AI literacy. Validity and reliability studies were conducted with 226 teachers. EFA results based on data from the same sample revealed a four-factor structure explaining 82.873% of the total variance: Awareness (eigenvalue = 4.904; variance explained = 40.866%), Use (eigenvalue = 1.975; variance explained = 16.975%), Evaluation (eigenvalue = 1.615; variance explained = 13.456%), and Ethics (eigenvalue = 1.452; variance explained = 12.096%). CFA results for the same sample indicated acceptable fit indices ($\chi^2 = 109.183$; df = 46; $\chi^2/df = 2.374$; p = .000; RMSEA = 0.078; NFI = 0.944; TLI = 0.952; CFI = 0.967; IFI = 0.967; GFI = 0.931), confirming the scale's factor structure. Reliability analyses showed high internal consistency, with Cronbach's alpha coefficients of .891 for Awareness, .932 for Use, .907 for Evaluation, and .821 for Ethics. The alpha value for all 12 items combined was .861, demonstrating strong reliability for both the subscales and the overall scale. The scale consists of 12 items—nine positively worded and three negatively worded (items 2, 5, 11)—distributed across four factors (awareness, use, evaluation, ethics). The items are rated on a five-point Likert scale ranging from "1 = Strongly disagree" to "5 = Strongly agree." Higher mean scores approaching 5 indicate higher levels of AI literacy.

Data Analysis

Microsoft Excel and Jamovi were utilized for the analysis of the collected data. Prior to conducting the analyses, the dataset was cleaned and organized to ensure accuracy and suitability for statistical procedures. Before performing the correlation analysis, descriptive statistics and fundamental assumption tests—including skewness, kurtosis, normality, and homogeneity tests—were carried out. Subsequently, independent samples t-tests were administered to examine differences in the variables based on gender. Finally, correlation analyses were conducted to determine the strength and direction of the relationships among the variables.

Findings

This section presents the findings obtained from the data collected in line with the main purpose and sub-objectives of the study.

Comparison of Turkish Language Teacher Candidates' AI Literacy and Heutagogical Learning Competency Levels by Gender

Table 2 presents the mean scores, standard deviations, kurtosis and skewness values, as well as the results of normality and homogeneity tests regarding Turkish language teacher candidates' AI literacy levels and heutagogical learning competency scores.

Table 2.
Descriptive Statistics and Preliminary Assumption Tests for Turkish Language Teacher Candidates' Scores

Variable	Category	n	x̄	ss	Normality Test (Kolmogorov-Smirnov)		Homogeneity Test (Levene's)	Skewness	Kurtosis
					W	p	p		
AI Literacy Level	Female	130	45.3	5.65	0.0807	0.229	0.409	-0.145	2.62
	Male	36	46.2	6.71				-0.907	1.15
Heutagogical Learning Competency	Female	130	79.5	9.62	0.0667	0.452	0.771	-0.173	0.729
	Male	36	77.4	8.45				-0.212	0.133

When examining the skewness and kurtosis values of the scores presented in Table 2, it was observed that the distribution of AI literacy scores for female teacher candidates was approximately symmetrical (female = -0.145) and slightly leptokurtic (female = 2.62). In contrast, the distribution of male teacher candidates' scores was negatively skewed (male = -0.907) and slightly leptokurtic (male = 1.15). The results of the normality and homogeneity tests indicated that the group variances were homogeneously distributed (Levene's test: $p > 0.05$) and the data followed a normal distribution (Kolmogorov-Smirnov test: $p > 0.05$).

For heutagogical learning competency, the distribution of scores for both female and male teacher candidates was symmetrical (female = -0.173; male = -0.212), and the kurtosis values close to 0 (female = 0.729; male = 0.133) suggest that the distributions closely approximated a normal curve. The results of the normality and homogeneity tests confirmed that the data were normally distributed (Levene's test: $p > 0.05$; Kolmogorov-Smirnov test: $p > 0.05$).

Table 3 presents the results of the independent samples t-tests conducted to examine differences in the scores of teacher candidates based on gender.

Table 3.
T-Test Results for Turkish Language Teacher Candidates' Scores by Gender

Variable	Category	n	x̄	ss	*t*	*p*
AI Literacy Level	Female	130	45.3	5.47	0.774	0.440
	Male	36	46.2	7.37		
Heutagogical Learning Competency	Female	130	73.4	10.6	-1.189	0.236
	Male	36	75.9	10.7		

In Table 3, the AI literacy variable was compared across different genders using an independent samples t-test. The group variances were found to be homogeneous (Levene's test: $p > 0.05$) and the data were normally distributed (Kolmogorov-Smirnov test: $p > 0.05$), allowing for the use of the t-test. The results

indicated that AI literacy levels did not differ significantly by gender ($p > 0.05$; females: $\bar{x} = 45.3$ $\bar{x} = 45.3$, ss = 5.65; males: $\bar{x} = 46.2$ $\bar{x} = 46.2$, ss = 6.71).

Similarly, the heutagogical learning competency variable was compared across genders using an independent samples t-test. The group variances were homogeneous and the data were normally distributed (Levene's test: $p > 0.05$; Kolmogorov-Smirnov test: $p > 0.05$), allowing the application of the t-test. The results showed that heutagogical learning competency levels did not differ significantly by gender ($p > 0.05$; females: $\bar{x} = 79.5$ $\bar{x} = 79.5$, ss = 9.61; males: $\bar{x} = 77.4$ $\bar{x} = 77.4$, ss = 8.45).

Perceptions of Turkish Language Teacher Candidates Regarding Competency Levels in the Subdimensions of AI Literacy and Heutagogical Learning Competency Scales

In order to determine teacher candidates' perceptions of contemporary competencies required in the digital age, the subdimensions of both heutagogical learning competencies and AI literacy were examined separately. The obtained data provide valuable insights into the candidates' competency levels in these areas, highlighting not only their strengths but also the areas that require further development. Table 4 presents the findings obtained in this context.

Table 4.

Perceptions of Turkish Language Teacher Candidates Regarding Competency Levels in the Subdimensions of AI Literacy and Heutagogical Learning Competency Scales

Heutagogical Learning Competency	
Learning to Learn	%81,42
Learner Autonomy	% 67.5
Self-Motivation	% 59,5
Self-Management	%75,5
AI Literacy Level	
Awareness	%81,3
Usage	%81,3
Evaluation	%77,3
Ethics	%76,6

The data presented in Table 5 indicate that Turkish language teacher candidates generally perceive themselves as highly competent in both heutagogical learning and AI literacy. However, within the heutagogical learning competencies, self-motivation and learner autonomy, and within AI literacy, the evaluation and ethics subdimensions were rated lower compared to the other subdimensions.

Relationship Between Turkish Language Teacher Candidates' AI Literacy and Heutagogical Learning Competency Levels

To examine the relationship between teacher candidates' AI literacy and their heutagogical learning competency levels, a correlation analysis was conducted based on the participants' perceptions. The findings obtained from this analysis are presented in Table 5.

Table 5.

Correlation Analysis of the Relationship Between Turkish Language Teacher Candidates' AI Literacy and Heutagogical Learning Competency Levels

	AI Literacy Level	Heutagogical Learning Competency	
		rho	p
AI Literacy Level	1	0.552***	<0.001

As shown in Table 5, since the data met the assumption of normality, a parametric analysis using Pearson correlation was conducted. The results indicated a positive and moderate relationship between Turkish language teacher candidates' AI literacy levels and their heutagogical learning competency levels (rho = 0.552, $p < 0.001$).

Discussion, Conclusion, and Suggestions

In this study, Turkish language teacher candidates' AI literacy levels and heutagogical learning competencies were examined across various variables, and the relationship between these two constructs was explored. The findings indicate that, in general, teacher candidates perceive themselves as highly competent in both areas. Similarly, Güven and Babayiğit (2020) reported that undergraduate students' heutagogical learning skills were at a moderate level. In the present study, the relatively high scores in learning to learn, self-management, and the AI literacy subdimensions of awareness and usage suggest that candidates have a strong perception of their ability to both manage their own learning processes and use digital technologies effectively. However, lower scores were observed in the heutagogical subdimensions of self-motivation and learner autonomy, as well as in the AI literacy subdimensions of evaluation and ethics. Aydın's (2024) study on AI research in Turkey highlights significant gaps in AI ethics, and the present findings similarly indicate that teacher candidates require further development, particularly in the ethical dimension of AI literacy.

Regarding the gender variable, the results showed no significant differences in either AI literacy levels or heutagogical learning competencies. Independent-samples t-test results, conducted after confirming normality and homogeneity assumptions, revealed that both female and male teacher candidates possess similar perceptions of competency in these domains. This finding aligns with previous research suggesting that digital literacy and self-determined learning skills can develop independently of gender (Kaya, 2021), implying that teacher education processes provide comparable opportunities for candidates of all genders.

One of the most noteworthy findings of the study is the positive and moderate significant relationship between AI literacy and heutagogical learning competencies. Pearson correlation analysis indicated that as AI literacy increases, heutagogical learning competencies also improve ($r = 0.552$, $p < 0.001$). This suggests that teacher candidates who understand and effectively use AI technologies have the potential to manage their learning processes more autonomously, motivatedly, and systematically. Consistent with the present study, numerous studies have shown that heutagogical learning skills contribute to learners' openness to learning, lifelong learning tendencies, creativity, and innovation (Badak & Şenel, 2022; Güven & Babayiğit, 2020; Öz & Şen, 2021). Therefore, teacher education programs that aim to holistically develop both AI literacy and heutagogical competencies through carefully designed content and learning experiences are likely to make a significant contribution to candidates' professional and personal growth. In this context, the study provides both theoretical and practical contributions to the field of teacher education in the era of digital transformation.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Data Availability Statement: The data are not publicly available; however, researchers seeking access to the data in future periods may contact the authors.

Conflict of Interest: There is no conflict of interest.

Generative Artificial Intelligence Statement: In the preparation of this manuscript, the PİRİ AI tool was utilized for literature review, while ChatGPT was employed for translation and language enhancement purposes. Additionally, the NotebookLM tool was utilized for creating infographics.

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Adaptation Study of the Digital Learning Competency Scale for Pre-Service Teachers

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Abstract

Recent studies report that individuals conduct their learning processes through digital environments. In this context, the concept of digital learning competency can contribute to students learning effectively in digital learning environments. This study aims to adapt the Digital Learning Competence Scale, which was validated and tested for reliability by Yang et al. (2021) on 3,473 middle school students in China, into Turkish and to conduct validity and reliability studies. The pilot form of the original scale is a 5-point Likert-type measurement tool consisting of six dimensions and a total of 39 items developed based on a comprehensive literature review: technology use, cognitive processing, digital reading skills, time management, peer management, and willpower management. The original scale was translated by language and field experts in line with the relevant purpose, and the resulting Turkish form was reviewed by a Turkish language expert, translator, measurement and evaluation expert, and Turkish field expert. The results obtained demonstrate that the developed DLC scale is a valid and reliable tool for assessing teacher candidates' digital learning competencies. The developed scale aims to contribute to the development of students' competencies for teachers and subject matter experts and to enable the planning of necessary training by determining students' digital learning competency levels. The findings of this study are intended to contribute to teachers and subject matter experts in developing students' competencies; furthermore, the scale is intended to enable the determination of students' DLC levels and the planning of necessary training in areas where it is needed.

Keywords: digital learning competency, pre-service teacher, validity, reliability.

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Introduction

Digitalization is a phenomenon that is fundamentally transforming the contemporary world, redefining all areas of life, including but not limited to education, art, economics, and culture. The advent of digital technologies has had a considerable impact on the dissemination of information, resulting in unprecedented levels of access. Individuals can now instantaneously access a plethora of sources and disseminate information with ease. However, this situation has also resulted in a significant increase in the volume of information, leading to a notable prevalence of misinformation, which has emerged as one of today's most pressing concerns. The accelerated and frequently unvalidated character of digital environments has served to intensify this issue, thereby contributing to the propagation of erroneous information. As asserted by Genge and D'Souza (2024), students are especially susceptible to being exposed to false or misleading information. This has the capacity to impede their ability to acquire information and to think critically. Conversely, the absence of a robust and verified digital learning platform serves to exacerbate the issue at hand, as students grapple with the challenge of sifting through the sheer volume of information available. Consequently, within such an environment, the ability to access and share accurate information necessitates not only the capacity to discern reliable sources but also the effective utilisation of digital literacy skills and digital learning competencies.

Digital literacy is a concept that is receiving increasing attention in public policy due to its provision of beneficial qualities and characteristics, both individually and socially (Schroot et al., 2024). Digital literacy has been identified by the European Commission as one of the eight key competencies for lifelong learning (European Commission, 2018). In this context, as educational environments become increasingly digital and individuals spend a significant portion of their time in digital environments, the effective use of these environments has become an important research topic. The profound integration of digital technologies into educational environments necessitates a redefinition of the professional competencies required of prospective teachers. In the contemporary educational landscape, the notion that teacher candidates should merely possess subject matter expertise and pedagogical knowledge has been superseded. The advent of digital learning environments has precipitated a paradigm shift, wherein the adept utilisation of technological tools to facilitate information access and management processes has become paramount. This paradigm shift has resulted in the prioritisation of digital learning competencies within teacher education programmes.

In view of recent advancements, the present study endeavours to adapt the Digital Learning Competency Scale, which was validated and subjected to reliability testing Yang et al. by (2021) in a study encompassing 3,473 middle school students in China, into Turkish for teacher candidates, with the objective of conducting validity and reliability studies.

Literature Review

Digital Competence and Digital Learning Competence

Digital literacy is conceptualized as the amalgamation of knowledge, skills, and attitudes that empower the critical and creative utilization of information technology (IT) and digital media to accomplish objectives pertinent to work, learning, and leisure. In order to utilise information technology (IT) in teaching in a safe and critical manner, to collaborate and communicate through IT, and to create electronic content, it is imperative that teachers attain mastery in the following areas of digital literacy (Santos et al., 2022; Tretinjak and Anđelić, 2016, p. 807). In the contemporary era, the advent of digitalization has led to a transformation and diversification of learning environments, thereby precipitating alterations in learning processes. Learning is a multifaceted process encompassing the acquisition of new knowledge, skills, values, attitudes, and behaviors through a myriad of experiences and interactions. Digital learning competence is conceptualized as an amalgamation of knowledge, skills, and attitudes that empower students to engage in efficient and effective learning by leveraging digital tools within digital learning environments (Yang et al. 2021, p. 2). Digital learning competencies can be defined as the knowledge, skills, attitudes, and values required to effectively use digital technologies for teaching, learning, and professional development. The digital transformation of education systems worldwide is driven by two factors: technological innovations and the imperative to prepare students for a rapidly evolving digital society. Consequently, the importance of digital learning competencies has increased exponentially.

Digitalization in education fosters the development of more effective, accessible, and innovative educational approaches by integrating conventional teaching methodologies with contemporary technological tools. This integration facilitates more efficacious learning outcomes for students, equips teachers with augmented resources and instruments, and enhances the overall efficiency of educational processes (Göknar et al., 2024). The potential for this technology to personalize learning processes and promote a culture of lifelong learning has been demonstrated (Parlak, 2017). Conversely, Schroot et al. (2024) posit that their study conducted in Turin, Italy, reveals the most significant impediment to digitalization in education to be the absence of adequate staff training, exacerbated by persistent time constraints. Furthermore, considerable disparities in the technical equipment of educational institutions and the skeptical attitudes of certain educators toward technology have considerably impeded the advancement of digital competencies delineated by European standards. This phenomenon also unveils contradictory circumstances, such as students referred to as "digital natives" exhibiting deficiencies in critical thinking and the utilization of digital resources for educational purposes. Therefore, irrespective of the extent to which opportunities may increase, the crux of the matter is that stakeholders in education In order to capitalize on the opportunities presented by digitalization and to develop the competencies essential to the digital landscape, a variety of policies have been proposed by prominent international organizations, including the European Union (EU), the Organization for Economic Cooperation and Development (OECD), and the United Nations Educational, Scientific and Cultural Organization (UNESCO). It is imperative that education and training frameworks evolve dynamically in response to the swiftly shifting demands of the digital economy (OECD, 2021; UNESCO, 2018; Vuorikari et al., 2022). The Digital Competence Framework for Citizens (DigComp) is a concept that was developed by the European Commission in order to establish a universal understanding of the constituent elements of digital competence. The DigComp framework consists of five primary areas of competence, which encompass a total of 21 distinct competencies. These areas of competence are enumerated below:

1. Information and Data Literacy: This area of study encompasses the identification of an individual's information requirements, the retrieval of relevant data, information, and content from digital environments, and the navigation of such environments. It further entails the formulation and refinement of personal search methodologies.
2. Communication and Collaboration: This area is predicated on the utilization of digital technologies to facilitate interaction and collaboration. Additionally, it involves an awareness of cultural and intergenerational diversity.
3. Digital Content Creation: This area of study encompasses the production, processing, and legal implications of digital content.
4. Security: It emphasizes the protection of devices, data, health, and the environment from potential threats within the digital landscape.
5. Problem Solving: This domain involves the capacity to address technological and conceptual challenges, identify needs, and foster ongoing development of digital proficiency.

In the present era, characterized by an accelerated digital transformation, the possession of these skills is no longer a matter of preference but rather a prerequisite for social and professional adaptation. A review of the literature on this subject in Turkey reveals that Afacan Adanır and Gülbahar (2022) adapted the "Basic Digital Competencies of University Students 2.0 – COBADI® Scale," which was developed based on the European Commission's Digital Competence (DigComp) Framework, into Turkish. This adaptation was carried out by Yılmaz et al. In 2021, the "Digital Teacher Competency Scale" was developed. In 2024, the "Informal Learning Competency Scale with Digital Tools" was created by Ocak et al. In 2022, Karakuş et al. developed the "Teacher Candidate Digital Competency Perception Scale." Toker et al. (2021) adapted the "Digital Competency Scale for Educators" into Turkish. Meanwhile, Uzun and Akay (2021) developed the "Teachers' Digital Material Creation Self-Efficacy Scale." It is evident, therefore, that the concepts of "digital competence," "digital literacy," and "digital learning" are gaining strategic importance both in the scholarship and in the policy documents of national and international organizations. Digital competence frameworks have been a popular topic of discussion in a variety of fields; however, their application in pedagogical contexts has been

somewhat limited. In light of this, there is an increasing demand to investigate students' digital learning competencies. This study was conducted with the objective of addressing this research gap.

Digital Learning Competence

The Digital Learning Competency (DLC) Scale was developed with the intention of facilitating effective student learning in digital learning environments. The framework consists of six dimensions.

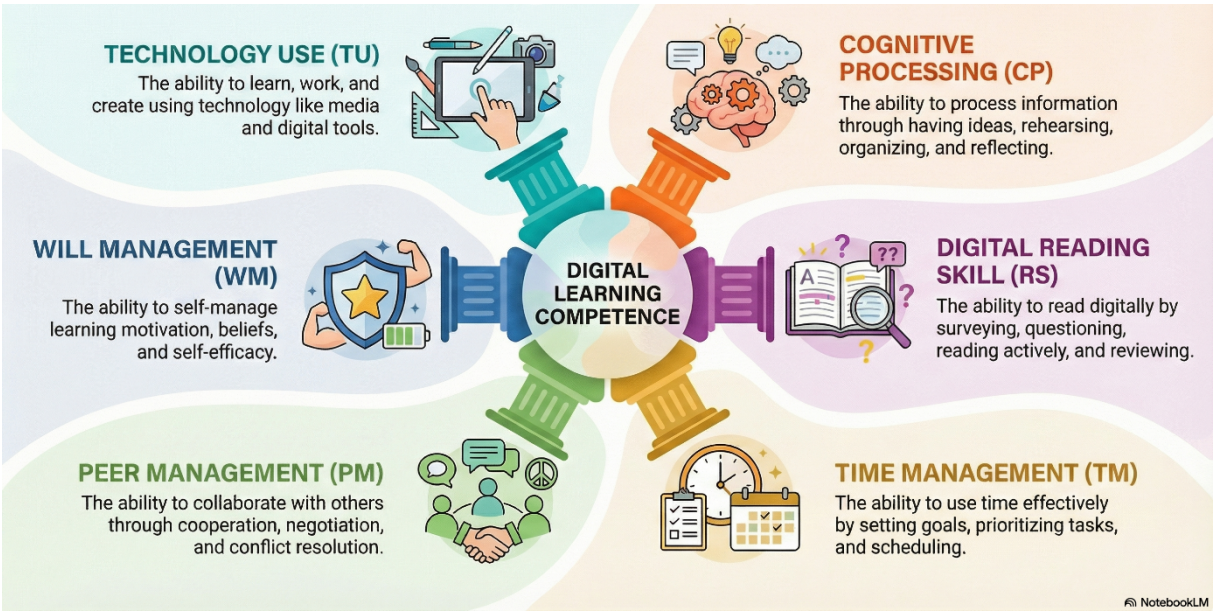


Figure 1. *The Digital Learning Competency (DLC) Scale (Yang et al., 2021).*

Of the six dimensions examined, Cognitive Processing, Digital Reading, and Technology Use have been identified as three fundamental factors contributing to digital learning proficiency. Peer Management, Time Management, and Willpower Management have been noted as management skills that facilitate the timely achievement of digital learning objectives (Yang et al., 2021).

Method

Research Model

The present study seeks to adapt the Digital Learning Competence Scale, which was validated and reliability tested by Yang et al. (2021) on 3,473 middle school students in China, into Turkish, and to conduct validity and reliability studies. Pursuant to this objective, the research model has been delineated as a scale adaptation study.

Research Group

The present study was conducted on a total of 470 teacher candidates enrolled at a faculty of education in Turkey during the 2025-2026 academic year. It is important to note that the data of 39 teacher candidates who participated in the pilot application were not included in the main application analyses.

Confirmatory Factor Analysis (CFA) was conducted on the dataset collated from 431 participants. The demographic characteristics of the study population are delineated in Table 1.

Table 1.
The demographic characteristics of the DFA group

	Groups	n	%
Gender	Female	117	27,14
	Male	314	72,85

	Total	431	100
Deparment	German Language Teaching	26	6,03
	Mathematics Teaching	16	3,71
	Music Education	14	3,24
	Early Child Education	24	5,56
	Guidance and Psychological Counseling	51	11,83
	Drawing and Crafts Education	3	0.69
	Social Studies Education	30	6,96
	Elementary Teaching	60	13,92
	Turkish Language Teaching	140	32,48
	Education of Mental Disabled	26	6,03
	English Language Teaching	41	9,51
	Total	431	100
Grade	1st grade	310	71,92
	2nd grade	35	8,12
	3rd grade	51	11,83
	4th grade	35	8,12
	Total	431	100

Data Collection Instrument

The Digital Learning Competency Scale: The scale was developed in 2021 by Yang, Tlili et al. The scale was developed for Chinese students (Cronbach's alpha = 0.94) and consists of 39 statements arranged on a 5-point Likert scale, with 1 indicating strong disagreement and 5 indicating strong agreement. The initial factor, denoted as technology use, comprises a total of nine items, exhibiting an eigenvalue of 12.811, thereby contributing to an overall Cronbach's alpha value of 0.870. The subsequent factor, designated as cognitive processing, encompasses seven items with an eigenvalue of 3.520, and generates a Cronbach's alpha value of 0.894. The third factor, termed "digital reading," consists of seven items with a factor loading of 2.176 (Cronbach's alpha = 0.867). The fourth factor, "peer management," consists of six items with a factor loading of 1.827 (Cronbach's alpha = 0.886). The fifth factor, time management, consists of six items with an eigenvalue of 1.360 and Cronbach's alpha of 0.858. The sixth factor, willpower management, consists of five items with an eigenvalue of 1.181 and Cronbach's alpha of 0.736.

Procedure

The scale employed in this study was meticulously selected through a comprehensive review of the relevant literature, ensuring the operationalization of the constructs to be measured was clearly delineated. The imperative for adapting the scale into Turkish was thoroughly substantiated, accompanied by a discourse on the cultural specificity of the constructs measured and their potential congruence with Turkish cultural contexts.

The present study accessed the Digital Learning Competence Scale, which was validated and tested for reliability by Yang et al. (2021) on 3,473 middle school students in China. A forward translation study was conducted using a preliminary questionnaire consisting of 41 items. Consequently, the English form of the scale was translated into Turkish by a language expert who is fluent in both English and Turkish and is proficient in both cultures, and by an expert in Turkish Education. Following the collection of the translations, they underwent a subsequent review by a language expert. The translations were then finalized with the input of a Turkish language expert, who ensured the clarity of the items and the

appropriateness of the sentence structures. In an effort to ascertain the language and cultural validity of the expert opinion form, a relevant form was circulated among a group of specialized reviewers. This group consisted of one translator, one expert in Turkish language and literature, one expert in Turkish language education, and one expert in measurement and evaluation. The reviewers were instructed to evaluate the form using a three-point scale that ranged from "Appropriate" to "Inadequate," with an intermediate category designated for "Needs improvement." In order to ascertain the cultural and linguistic appropriateness of the scale, content validity ratios were calculated. Following the collection of pertinent opinions, the scale items were subjected to revision, and subsequent to the implementation of these corrections, it was determined that the scale contained no unclear or ineffective statements. The pilot application of the 41-item scale was conducted on a sample of 39 individuals. Following the pilot application, the requisite corrections were implemented, and it was determined that the 41-item scale would be applied to the primary sample group. The application required approximately six minutes. Consequently, a sample size was established at the level recommended by Acar Güvendir et al. (2025) for CFA (400 and above), with attention given to ensure maximum diversity.

The psychometric soundness of the scale was investigated through a series of validity studies, commencing with Confirmatory Factor Analysis (CFA).

This analytical procedure was implemented to evaluate the construct validity of the scale. The reliability analysis entailed the calculation of Cronbach's alpha and McDonald's ω coefficient. The comprehensive data analysis undertaken in this study was facilitated by the utilization of the Jamovi statistical software.

Data Analysis

In order to assess the construct validity of the scale, Confirmatory Factor Analysis was performed. Meanwhile, in order to conduct a reliability analysis, Cronbach's Alpha analysis was conducted.

As defined by the American Educational Research Association (AERA), American Psychological Association (APA), and National Council on Measurement in Education (NCME) in 2014, validity refers to the degree to which the scores obtained from a test can be interpreted in line with the purpose of the test and supported by theory or evidence. Reliability, on the other hand, is the degree to which measurement results are free from random errors. The most suitable reliability determination method should be selected on the basis of the qualities measured by the measurement tool. The Cronbach Alpha coefficient, which provides reliability information in terms of internal consistency, is a reliability coefficient utilised in tools where items are weighted or options are prepared according to a rating scale. The Cronbach alpha coefficient is

According to Özdamar (1999), the reliability levels are denoted as follows:

0.0 $\leq \alpha \geq 0.40$ – not reliable $0.40 \leq \alpha \geq 0.60$ – low level of reliability $0.60 \leq \alpha \geq 0.90$ – quite reliable $0.90 \leq \alpha \leq 1.00$ – high level of reliability

Findings

Findings Regarding Validity

The pilot items were translated into Turkish by three individuals, after which the relevant items were edited by researchers and a Turkish language expert, and the items were reviewed by one measurement and evaluation expert. In order to determine linguistic and cultural appropriateness, opinions were sought from ten experts. Based on these opinions, the content validity index was calculated as 0.8.

Findings Related to Confirmatory Factor Analysis

Confirmatory Factor Analysis (CFA) was conducted using Jamovi to validate the structural integrity of the original scale in Turkish.

In accordance with the suppositions underlying confirmatory factor analysis (CFA), missing data, multivariate outliers, and multicollinearity tests were conducted. Upon scrutinizing the covariance values among the factors, substantial relationships were ascertained between all factors ($p < .001$). The range of the standardized covariance values between factors varied from 0.23 to 0.81. The highest correlation was identified between Factor 4 and Factor 5, with a coefficient of .805, while the lowest positive correlation was observed between Factor 1 and Factor 3, with a coefficient of .230. Various fit

indices indicating the model's fit were examined during the analysis. Following the implementation of confirmatory factor analysis, items exhibiting low factor loadings, as well as those displaying similar loadings on multiple factors (m6, m9, m13, m15, m16, m21, m23, m27, m29, n30, m32, m33), were eliminated from the model. Subsequently, modifications were made to m36 and m37. It is evident that modifications were implemented between m1 and m2. Upon examining the fit indices that were obtained subsequent to the removal of items As indicated in Table 1, the chi-square divided by degrees of freedom ($\chi 2/df$) was determined to be 1.75, with a p-value less than 0.001. Additionally, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Non-Normed Fit Index (NNFI), the Relative Fit Index (RFI), the IFI, and the PNFI were found to be .948, .941, .941, .888, .874, and .787, respectively.

Table 2.
Model fit measurement statistics

Conformity Index	**Threshold Value**	**Value Obtained**	**Comment**
$\chi 2/sd$	≤ 3	**1.75**	Good Fit
RMSEA	≤ .08	**.042**	Perfect Fit
SRMR	≤ .08	**.043**	Perfect Fit
CFI	≥ .90	**.948**	Good Fit
TLI	≥ .90	**.941**	Good Fit
NNFI	≥ .90	**.941**	Good Fit
RNI	≥ .90	**.948**	Good Fit
NFI	≥ .90	**.888**	Acceptible Fit
RFI	≥ .70	**.874**	Good Fit
IFI	≥ .90	**.948**	Good Fit
PNFI	≥ .50	**.787**	Perfect Fit

The path diagram of Confirmatory Factor Analysis is illustrated in Figure 2.

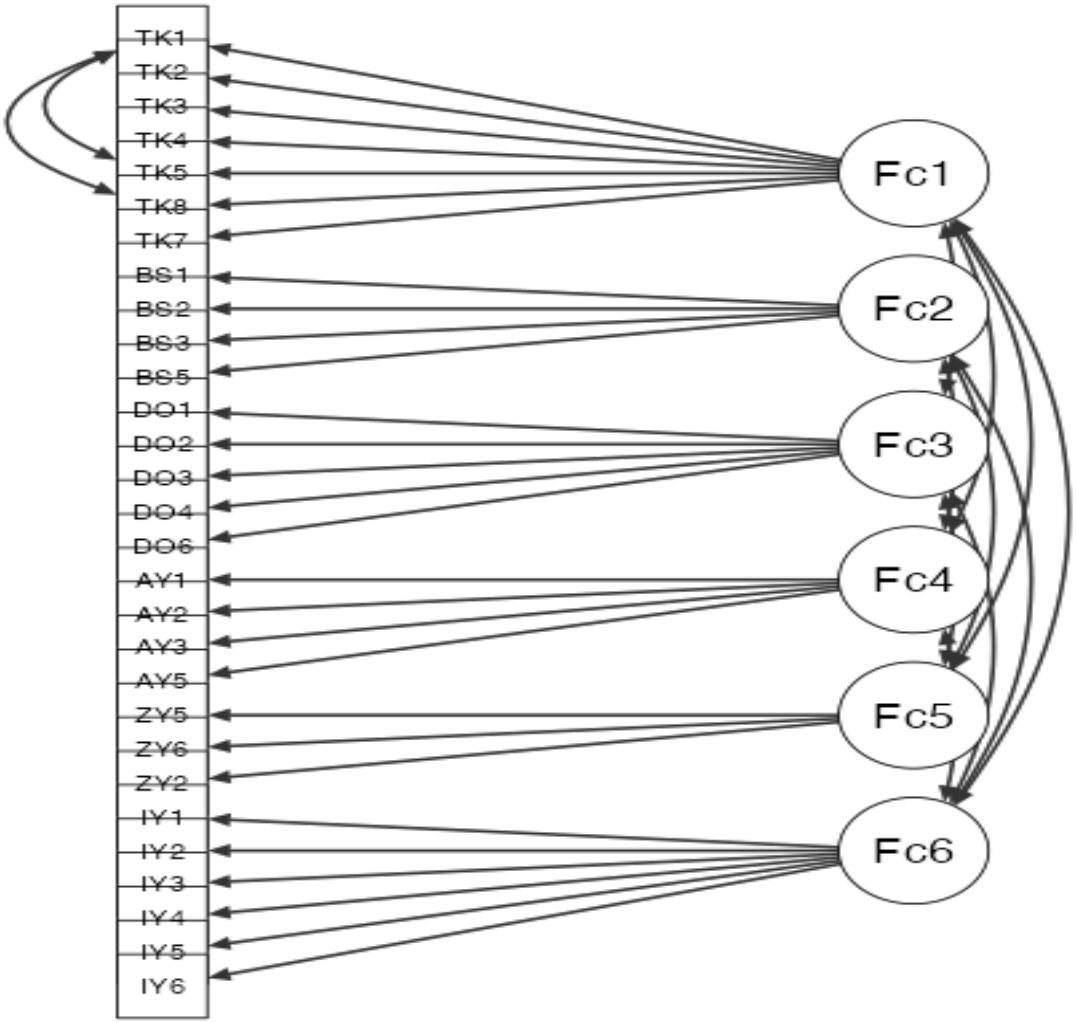


Figure 2.

Confirmatory Factor Analysis path diagram

Item-Total Correlation Analysis Findings

Ultimately, in the study, the item-total correlation was computed for each item on the scale (see Table 3).

Table 3.

The Digital Learning Competency Scale Factors and Item-Total Correlation Values

Factor	Items	Item-Total Correlation	Number of Items
Factor 1 (Technology Use)	i1	.612	7
	i2	.661	
	i3	.504	
	i4	.510	
	i5	.621	

	i7	.659	
	i8	.568	
Factor 2	i10	.751	
(Cognitive Process)	i11	.743	4
	i12	.793	
	i14	.71	
	i17	.551	
Factor 3	i18	.521	
(Digital Reading Skills)	i19	.651	5
	i20	.514	
	i22	.552	
	i24	.669	
Factor 4	i25	.631	4
(Peer Management)	i26	.732	
	i28	.609	
	i31	.512	
Factor 5	i34	.571	3
(Time Management)	i35	.565	
	i36	.664	
	i37	.698	
Factor 6	i38	.565	
(Will Management)	i39	.578	6
	i40	.533	
	i41	.637	

A review of the item-total correlation values in Table 3 reveals that the range of these values extends from .510 to .793. In accordance with the established criteria (Tezbaşaran 1997), items with values exceeding 0.40 were not subject to removal.

Findings Relating to Reliability

In the present study, Cronbach's Alpha (α) and McDonald's Omega (ω) coefficients were calculated in order to determine the reliability level of the 6-factor Digital Learning Scale, which consists of 29 items, as a result of DFA (see Table 4).

Table 4.
The Digital Learning Competency Scale: An Examination of its Factors and Reliability Values

Factor	Items	Cronbach Alfa (α)	McDonald Omega (ω)
	i1		
	i2		
Factor 1	i3		
(Technology Use)	i4	.836	.841

	i5		
	i7		
	i8		
Factor 2	i10		
(Cognitive Process)	i11	.884	.886
	i12		
	i14		
	i17		
Factor 3	i18		
(Digital Reading Skills)	i19	.779	.785
	i20		
	i22		
	i24		
Factor 4	i25		.835
(Peer Management)	i26	.830	
	i28		
	i31		
Factor 5	i34	.726	.731
(Time Management)	i35		
	i36		
	i37		
Factor 6	i38		
(Will Management)	i39	.836	.838
	i40		
	i41		
Total		.882	.892

A close examination of the Cronbach Alpha (α) and McDonald Omega (ω) values presented in Table 4 reveals some interesting insights. First, regarding the first factor, the Alpha value is .836, and the Omega value is .841. Second, for the second factor, the Alpha value is .884, and the Omega value is .886. Third and finally, for the third factor, the Alpha value is .779, and the Omega value is .785. The fourth factor (α = .830, ω = .835), the fifth factor (α = .726, ω = .731), and the sixth factor (α = .836, ω = .838) have been determined to exhibit high levels of reliability. The reliability values obtained for the entire scale (α = .882, ω = .892) also indicate that the scale is highly reliable. In the instance of item deletion executed on a factor basis, it was ascertained that each item deleted resulted in a reduction of the internal consistency coefficient. Consequently, it was deduced that the deletion of any item from the scale does not enhance internal consistency and that all items contribute positively to the reliability of the scale.

Conclusion

The present study endeavored to adapt the Digital Learning Competency Scale, initially developed by Yang et al. (2021), into Turkish. This adaptation process entailed a series of methodological steps aimed at ensuring the linguistic and cultural equivalence of the scale. These steps included back-translation, solicitation of expert opinions, calculation of the content validity index, and pilot testing. The objective

of these methods was to ascertain the validity and reliability of the adapted scale. Following expert evaluations, it was determined that the scale items were culturally appropriate for Turkish culture. A content validity index of .80 indicated that the items had sufficient representativeness.

Subsequent to the Confirmatory Factor Analysis (CFA) undertaken to ensure construct validity, it was evident that the six-factor structure inherent in the original scale was also confirmed in the Turkish form. During the analysis process, items exhibiting low factor loadings or those which had an adverse effect on model fit were eliminated; the requisite relationships were incorporated into the model in accordance with the modification suggestions. The obtained fit indices (χ^2/df=1.75, CFI=.948, TLI=.941, RMSEA=.042, SRMR=.043) indicate an adequate fit between the model and the data. Furthermore, the meaningfulness and reasonableness of the covariances between factors supports the consistency of the scale's theoretical structure with the data.

Cronbach's Alpha and McDonald's Omega were utilised in reliability analyses, and given the multi-factor structure of the scale, the coefficients of each factor were evaluated independently. Accordingly, the fact that the coefficients ranged from .72 to .88 for all factors and from .882 to .892 for the scale in its totality indicated that the scale exhibited a high degree of internal consistency. Moreover, the item-total correlations, which were found to be above .50, demonstrated that all items contributed consistently to the measured structure, thus rendering the removal of any items unnecessary.

It was determined that the Digital Learning Competency Scale is a valid and reliable instrument for measuring teacher candidates' digital learning competencies. In contemplating the ramifications of digital transformation within the domain of education, it becomes imperative to assess the digital learning competencies of teacher candidates and to discern domains necessitating development. This is paramount with respect to both the caliber of teacher training programs and the aptitude of learning processes to adapt to digital environments. As Karakuş et al. (2022) note, it is imperative that teachers who aim to cultivate digital competencies in their students possess these competencies/skills themselves. The present scale thus offers a framework for education stakeholders to assess teacher candidates' digital learning competencies and make decisions regarding improvements to teaching programs.

In sum, this study addresses a significant lacuna in the Turkish literature concerning the assessment of pre-service teachers' digital learning competencies. It offers a valid and reliable assessment instrument that can be utilized to evaluate the knowledge, skills, and attitudes necessary for the digitalization process in education.

Acknowledgment

Ethics Statement: It is hereby declared that the present study is in accordance with the regulations stipulated in the "Higher Education Institutions Scientific Research and Publication Ethics Guidelines." Furthermore, it is affirmed that no actions falling under the purview of "Actions Contrary to Scientific Research and Publication Ethics" have been undertaken.

We hereby declare that there is no conflict of interest among the authors, that all authors contributed to the study, and that all responsibility for any potential ethical violations lies with the authors of the article.

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Data Accessibility Statement: Researchers should contact the authors to access the data utilized in the study.

Conflict of Interest Statement: No conflict of interest is pertinent to this study.

Use of Artificial Intelligence: ChatGPT, Scopus AI, and NotebookLM were utilised for the literature review, Google Translate and DeepL were employed for translation, and NotebookLM was used to create infographics during the preparation of this article.

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DİJİTAL ÖĞRENME YETERLİĞİ ÖLÇEĞİ

	Kesinlikle katılıyorum	Katılıyorum	Ne katılıyorum ne katılmıyorum	Katılmıyorum	Kesinlikle katılmıyorum
M1: Bilmediğim bir yere gezmeye gitmeden önce navigasyonu (haritaları) seyahat rotalarımı planlamak için kullanabilirim.					
M2: Bilmediğim bir yerde gezerken varış noktama ulaşmak için yol işaretlerini kullanabilirim.					
M3: İlk defa kullanacağım ev aletlerini doğru şekilde çalıştırabilmek için kullanım kılavuzuna başvurabilirim.					
M4: Resim, animasyon ve video gibi çeşitli biçimlerde multimedya ürünleri oluşturmak amacıyla dijital uygulamaları (Canva, Animaker, Powtoon vb.) kullanabilirim.					
M5: Bir video veya ses kaydında önemli noktaları belirleyebilirim.					
M7: Kendi oluşturduğum multimedya ürünlerimi arkadaşlarımla paylaşmak için WhatsApp, e-posta veya flash bellek gibi araçlardan uygun olanını seçebilirim.					
M8: Kendi multimedya ürünlerimi değerlendirir, düzenler ve geliştiririm.					
M10: Öğretim elemanlarının dersi veya sunumu sırasında hatırlanması gereken önemli noktaları belirleyebilirim.					
M11: Sınıf tartışmalarındaki önemli bilgileri belirleyebilirim.					
M12: Ders içeriğini daha iyi kavramak için öğretim elemanının anlatımını, ders kitabını ve sınıf tartışmalarını birbirleriyle ilişkilendirerek birleştiririm.					
M14: Sınavdan önce önemli noktaları listeler ve onları hatırlamak için elimden geleni yaparım.					
M17: Makaleyi okuduktan sonra, önemli konuları ve metin yapısını resim veya tablo çizerek özetlerim.					
M18: Kitap, gazete veya dergi okurken not alma alışkanlığım vardır.					
M19: Gazete ve dergi okurken, sonraki okumalarımı yönlendirmek için makalenin başlığını soruya çevirebilirim.					
M20: Yeni bir makaleyi okuyup anlamaya çalışırken önce metin altı sorularını okur ardından makaleyi okurum.					
M22: Daha önce okuduğum öğrenme materyallerini düzenli olarak gözden geçiririm.					
M24: Grup öğrenmelerinde, kendi görüşlerimi arkadaşlarıma ifade edebilirim.					
M25: Grup tartışmalarında fikir ayrılığı yaşandığında uzlaşmaya aktif şekilde katkı sağlayabilirim.					

M26: Grup etkinliklerinde kendi rolümü ve sorumluluklarımı açıkça tanımlayabilirim.					
M28: Grup öğrenmelerinde arkadaşlarımın özgürce konuşmalarını sağlamak için çeşitli yollar bulabilirim.					
M31: Öğrenme görevimi tamamladığımda, planla karşılaştırarak görevin eksiklerini kontrol ederim.					
M34: Öğrenme görev planını hazırlarken, görevlerin önem ve aciliyet sırasına göre bir öncelik belirlerim.					
M35: Öğretim elemanı tarafından verilen ödevleri zamanında tamamlayabilirim.					
M36: Elimden gelen tüm çabayı gösterdiğim sürece bilgi edinebileceğime inanırım.					
M37: Yöntem uygun olduğu sürece bilgi edinebileceğime inanırım.					
M38: Yüksek notlar almak, beni en çok mutlu eden şeydir.					
M39: Okulda verilen öğrenme içeriklerine ilgi duyarım.					
M40: Her dersten iyi bir sonuç alabileceğime inanırım.					
M41: Kendi güçlü ve zayıf yönlerimi tanıyabilirim.					

Daily Life Problem-Solving Skills in the Context of Science Education: An Analysis of Theory, Scope, and Educational Implementation

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Abstract

This study examines the theoretical model of "Daily Life Problem-Solving Skills", which comprises twenty distinct skills. Conducted employing the document analysis method, this study reveals that skill is not merely an innate predisposition but a dynamic attribute that develops through continuous learning and practice. The study focuses on the complex and uncertain problems of daily life, in contrast to traditional, structured problem-solving approaches. The development of this skill set contributes to making learning more meaningful and lasting by enabling students to connect theoretical knowledge with real-life experiences. The twenty skills examined in the study aim to enhance not only the individual's academic success but also their competencies at a personal and societal level. Consequently, the study presents a fundamental approach for integrating these skills into curricula, restructuring pedagogical methods, and providing teacher training. This approach aims to prepare students for lifelong learning and adaptation, thereby enabling them to participate in society as more integrated and prosperous individuals.

Keywords: Daily Life Problem-Solving Skills, Structured and Unstructured Problems, Structured Applied Pedagogy, Curriculum Integration, Holistic and Systemic Thinking Approach.

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Introduction

The concept of skill is addressed through various approaches in academic literature. At the most fundamental level, a skill is defined as an individual's ability to complete a task, effectively manage a process, and achieve a desired outcome, resulting from both innate predispositions and acquired learning. In this context, Püsküllüoğlu (2000) regards skill as the abilities of individuals to accomplish a job, perform an operation appropriately, and conclude it as required by the operation, depending on their predispositions and learning. This definition emphasises the multidimensional structure of skill, encompassing both innate potential (predisposition) and subsequently acquired knowledge (understanding).

On the other hand, Doğan (2025) introduces a more dynamic perspective on the nature of the skill concept, defining skill as the ability to successfully perform a specific job that an individual develops through knowledge, experience, and practice. Doğan's definition reveals that skill is not merely a passive ability, but rather a dynamic quality that is shaped, developable, and transformable through a continuous process of learning and application. This approach suggests that skill is a dynamic process acquired and reinforced through the individual's active participation, rather than being a fixed, innate characteristic.

Both definitions regarding the concept of skill unite its fundamental elements on a common ground; however, while Püsküllüoğlu (2000) predominantly emphasises the output-oriented aspect of skill, Doğan (2025) focuses on the developmental and dynamic dimension of skill during its formation process. These differing approaches demonstrate the comprehensive and multifaceted nature of the skill concept field.

When examining the literature in the field of education, it is observed that strengthening the connection between the knowledge contained in school curricula and real life has distinct positive effects on the efficiency and permanence of learning processes. Increased student interest in lessons, the development of their ability to effectively apply learned knowledge outside the school environment, and ultimately rendering learning more meaningful and effective are direct consequences of this relationship (Özmen, 2003; Fortus et al., 2005; İlkörücü Göçmençelebi, 2007). This situation emphasises the pedagogical importance of moving beyond knowledge remaining merely as a theoretical construct and enriching it with concrete and practical applications.

Examining the historical development of educational programmes in Turkey, it is evident that the fundamental aim of science education, in particular, has evolved towards preparing individuals for life. This transformation is based on the notion that science should cease to be solely a conceptual body of knowledge and become a tool that enables the individual to cope with the difficulties of daily life. In this context, it is of great importance to equip individuals with a set of fundamental mental skills that will enable them to succeed in the situations they encounter throughout their lives.

Throughout their lives, people are confronted with various problems and feel the need to solve them (Ünsal & Ergin, 2011). These challenges prompt individuals to seek solutions, making their daily lives more orderly and functional (Baki, 2008; Stanic & Kilpatrick, 1989). Indeed, every new stress-inducing situation encountered in daily life can be evaluated as a problem situation that the person must overcome (Lee, 2005). Therefore, it is a significant necessity for the education system to equip individuals for such problem situations and to provide them with the ability to develop different solution paths. Education must foster a culture that supports individuals' lifelong learning and adaptation abilities.

The literature offers various classifications in the fields of education and cognitive sciences to understand the solution processes of encountered problem situations. In this context, structured problems and daily life problems are accepted as two prominent fundamental types of problems. The nature of structured problems plays a significant role in developing problem-solving skills, particularly in fields such as mathematics and science. Studies in the literature also emphasise the importance of these two problem types (Orton & Wain, 1994; Van De Walle, 2001).

Structured problems, by their nature, possess an apparent and determinate structure. Such problems can be defined as situations where the steps to be followed for a solution and the formulae to be applied are generally known beforehand. As stated by mathematics educator Polya, a structured problem requires the application of a previously learned rule, formula, or solution strategy to the current problem situation

(Polya, 1981). In this context, all data and conditions necessary to solve a problem are clearly presented in the problem's text.

The fundamental characteristics of structured problems are as follows:

- Distinct Problem Elements: All components constituting the problem (data, conditions, and goal) are entirely included within the content of the problem. Thus, the problem solver knows precisely what they are facing before commencing the solution process.
- Single Correct Answer: Such problems generally have a single correct solution. This feature facilitates the evaluation of the problem's solution and the measurement of the learning process. The student or problem solver can clearly see the success of the solution process by reaching the correct answer (Şencan, 2013).
- Closed-Endedness: The closed-ended structure of structured problems means that there is not much flexibility for different paths or creative approaches to the solution. The solution generally proceeds through a predetermined algorithm or logical sequence.

This type of problem is widely used in education, particularly for reinforcing basic knowledge and skills, developing algorithmic thinking abilities, and teaching standard solution methods. However, this structure may not fully reflect the ability to solve more complex and uncertain problems encountered in daily life. Therefore, modern educational approaches focus on problem types that are related to daily life and are more complex, in addition to structured problems.

In the problem-solving process, the complex and unstructured situations individuals face cannot be overcome solely by applying memorised formulae or predetermined solution paths. In this context, the effective resolution of daily life problems critically requires the individual's existing knowledge base and the ability to integrate this knowledge into real-life contexts (Gür, 2006).

In the literature, structured problems are generally treated as having clear and well-defined characteristics. In such problems, all necessary data and information for the solution are clearly presented within the problem itself. For instance, a mathematics question contains all the numerical data and constraints necessary to reach the solution. However, unstructured problems are distinctly separated from this category. By their nature, it is not possible to access all the information required for the solution from the problem text. This situation highlights the need for the individual solving the problem to actively search for, collect, and evaluate any necessary additional data and information before or during the solution process. This process activates the individual's cognitive flexibility, research skills, and critical thinking abilities.

Another important characteristic of unstructured problems is that a single correct answer rarely exists. Such problems offer a multidimensional structure where multiple solution paths and even different solutions may be possible (Şencan, 2013). This situation requires cognitive flexibility from individuals seeking a solution; that is, the ability to view things from different perspectives and employ creative thinking skills rather than adhering to a single approach. While this process contributes to the development of the individual's problem-solving skills, it also enriches their strategies for coping with complex situations. Therefore, the solution to problems encountered in daily life is a dynamic process that requires constructing the most appropriate solution that best fits the situation, rather than merely focusing on finding the correct answer.

In this context, solving unstructured problems requires the application of higher-order thinking skills in the academic sphere.

It has been observed that individuals employ two fundamental cognitive strategies in solution-finding processes, whether they involve structured problems encountered in formal educational environments or natural problems arising from daily life (Mayer & Hegarty, 1996). The first of these strategies is the direct translation strategy, which involves directly applying a previously learned or experienced solution path to a new situation with similar characteristics. This approach employs a "template copying" logic, focusing on similarities in the surface structure of the problem.

The second strategy is the modelling strategy, which is based on creating an abstract representation or model of a situation by deeply analysing the relationships and quantitative data underlying the problem. Unlike the "solve first, think later" logic, this approach places greater emphasis on understanding and structuring the problem. That is, it aims to construct a new, situation-specific solution path by grasping the essence of the problem through quantitative reasoning (Hegarty et al., 1995).

Individuals with a tendency to solve problems, particularly as a result of habits acquired in education systems, frequently tend to focus on numerical data and keywords in the text rather than understanding the problem as a whole (Hegarty et al., 1995). While this practice may seem efficient for solving structured mathematics problems, it carries significant risks when applied to the complex and context-dependent problems of daily life.

Studies in the literature strongly suggest that this type of superficial solution strategy often yields erroneous results when applied to formal problems in contrast to realistic contexts of daily life (Verschaffel et al., 1992). For example, the assumption that a keyword like "total" in a problem text automatically corresponds to addition can lead to disregarding the realistic context of the problem. This incorrect transfer prevents individuals from producing rational and valid solutions to real-world problems (Greer, 1993; Verschaffel et al., 1994; Hegarty et al., 1995; Yoshida et al., 1997; Xin et al., 2007). This situation indicates that problem-solving skills consist not only of algorithmic knowledge but also require deep understanding and situational reasoning ability.

In science education, the connection of subjects in the curriculum with the real world is of critical importance. Science curricula possess the potential to establish a direct relationship between subjects and events and situations in daily life (Evcim, 2010). In this context, it is observed that the learning-teaching processes of the Science course focus on developing individuals' abilities to produce solutions to daily life problems they encounter (Coştu et al., 2007; MEB, 2013; 2018). This approach aims to render theoretical knowledge functional beyond mere transmission.

Consequently, science teaching enables students to understand better the events occurring in their environment, interpret them from a scientific perspective, and produce solutions by applying the knowledge they have acquired in school to practical problems. This process not only increases individuals' knowledge accumulation but also strengthens their lifelong learning skills and problem-solving abilities by using this knowledge. This situation demonstrates that science education is a strategic area that contributes to individuals becoming more conscious and competent in their daily lives, beyond being merely an academic discipline. In this context, offering meaningful and contextual learning experiences rather than rote memorisation of knowledge will also positively affect students' attitudes towards science.

The ability of individuals to effectively solve problems encountered in daily life represents a skill set that is generally underemphasised in modern educational understanding but is of vital importance for an individual to be successful and adaptable throughout their life (Doğan, 2025). In this context, the importance of Daily Life Problem-Solving Skills is not limited to academic success alone; it ensures that the individual is resilient and competent in the face of complex and dynamic challenges they may encounter at every stage of life.

This skill area supports individuals in making informed decisions by thinking strategically in their professional careers, undertaking an active and constructive role in their social environment, and fostering healthier and more empathetic communication in their personal life, including family relationships (Doğan, 2025). Therefore, a greater focus by education systems on these skills will ensure that students participate in society as more integrated and prosperous individuals, endowing them with lifelong learning and adaptation abilities, rather than merely equipping them with knowledge.

Daily life problem-solving skills are defined as the ability of individuals to produce practical, functional, and creative solutions to the complex problems they encounter in the social, economic, and environmental contexts in which they live (Doğan, 2025). The development of these skills not only enhances success at the individual level but also plays a crucial role in promoting societal welfare and sustainability. In this context, the benefits provided by these skills are given below (Doğan, 2025):

- Adaptation to Real Life and Interdisciplinary Integration: While education systems generally focus on theoretical knowledge transfer, daily life problem-solving skills ensure the applicability of this theoretical knowledge to concrete and practical scenarios. This enables the interdisciplinary integration process, which refers to individuals being able to use the abstract concepts they learn in school to cope with uncertain and multifaceted problems in real life. These skills transform individuals from passive consumers of knowledge into active problem solvers and innovators.
- Lifelong Learning and Development Process: Problem-solving competencies are among the fundamental components of individuals' lifelong learning journey. These skills, acquired from early childhood, strengthen the individual's capacity to cope with difficulties they will encounter at every phase of life, from their career to personal relationships, from financial management to health problems. These competencies equip the individual with the flexibility not only to solve current problems but also to anticipate and adapt to potential future challenges. This significantly increases the perception of personal resilience and self-efficacy.
- Holistic and Systemic Thinking Approach: Problem-solving skills are a whole series of cognitive and affective competencies that interact with and support one another, rather than being singular and independent abilities. Elements such as creative thinking, critical analysis, effective communication, collaboration, and emotional intelligence come together like parts of a system, allowing for more innovative and inclusive solutions to problems. This holistic approach enables the individual to evaluate complex problems from different angles and develop multidimensional solutions.
- Structured Applied Pedagogy: The acquisition of these skills requires structured applied pedagogy, unlike traditional, rote-based teaching methods. The learning process is enriched with practical applications, including real case studies, simulations, project-based learning, and field experiences. These methods enable students to experience theoretical knowledge in a concrete context and internalise how to integrate acquired knowledge into their daily lives. This approach increases the permanence and transferability of knowledge.
- Contribution to Societal Development and Sustainability: Individuals who can effectively solve problems not only increase their own personal success but also provide wider societal benefits. By demonstrating sensitivity to environmental issues, social inequalities, or economic challenges, these individuals take an active role in developing innovative and sustainable solutions. This indicates that individual competencies are among the fundamental drivers of societal transformation and progress.

Daily Life Problem-Solving Skills, for which theoretical foundations were laid and developed by Doğan (2025), presents a comprehensive structure consisting of twenty different skills as a theoretical model. This model systematically classifies competencies that will enable individuals to cope with various challenges they encounter in their daily lives. However, the relevant literature currently lacks a sufficient accumulation of detailed analysis and publications focused on the applications of this skill classification. This situation points to the existence of a significant theoretical and practical gap in the field.

In this context, it is of great importance to clearly define what Daily Life Problem-Solving Skills entail, their constituent components, and their place in the educational sciences literature. This classification by Doğan (2025) diverges from traditional problem-solving approaches due to its unique structure and offers a holistic approach that covers not only cognitive but also affective and social aspects of individuals. Examining each of these skills individually and deeply analysing their theoretical structure will prepare a solid ground for how this theory can be applied in education.

The primary aim of this study is to fill the aforementioned gap in the literature and present a practical guide for educators. This guide, based on Doğan's (2025) model, will provide concrete strategies and methods for integrating Daily Life Problem-Solving Skills into curricula and processes. In this way, it is aimed that students are raised not only to acquire academic knowledge but also as individuals equipped to solve problems they encounter in real life. This guide will serve as a beacon for teachers and curriculum developers on the path to equipping students with these critical skills.

The integration of this skill classification into the education system will contribute to students becoming individuals who can produce resilient and creative solutions to problems they will encounter not only in the classroom environment but throughout their lives.

Method

The fundamental aim of this study is to systematically examine the classification contained in the book "Daily Life Problem Solving Skills" penned by Doğan (2025) and to reveal the knowledge and approaches presented regarding daily life problem-solving skills. In line with this aim, the document analysis method, a qualitative research approach, was employed. Document analysis is a method based on deeply examining existing written materials (books, journals, articles, reports, newspapers, etc.) to extract meaning (Yıldırım & Şimşek, 2021). This method involves the systematic analysis of data obtained from physical and digital documents (Bowen, 2009).

Document Analysis Process

The sole document examined within the scope of the study is the book "Daily Life Problem Solving Skills" written by Doğan (2025). The analysis process was structured in accordance with the stages suggested by Yıldırım and Şimşek (2021).

- **Access to Documents:** In line with the aim of the study, the book to be examined was identified, and access to its printed version was secured.
- **Checking Originality:** The relevant document was confirmed as an academic publication, and the content of the book was found suitable for the aim of the study. At this stage, the reliability and authenticity of the document were reviewed.
- **Understanding Documents:** The book was read in its entirety to gain a general impression of its central idea and content. This reading was conducted to understand the general structure of the book and the topics it covers.
- **Analysis of Data:** This stage constitutes the most important part of the document analysis process. Using the content analysis technique, themes, concepts, and approaches related to daily life problem-solving skills were identified within the book. In this process, data were coded and grouped under a thematic structure.

One of the most significant advantages of document analysis is that it enables the examination of data related to past and current events, requiring less time and cost compared to other data collection methods (Yıldırım & Şimşek, 2021). Bowen (2009) also views document analysis as a complementary strategy that can be used to support other qualitative research methods (e.g., interviews or observations). In this study, document analysis served as the primary data source.

Findings

This section presents a systematic summary of the classification within the scope of data obtained from the qualitative document analysis of the book "Daily Life Problem Solving Skills" penned by Doğan (2025). In this section, twenty different skills within the scope of daily life problem-solving skills were examined. For each skill, the definition of the skill was provided, followed by a detailed discussion of the factors affecting it and strategies for developing it. This thematic structure clearly reveals the approach and scope of the examined book regarding daily life problem-solving skills.

Decision Making

Decision-making is the process of selecting the most appropriate option from among available alternatives by a person or group. This process is not merely an instantaneous choice but involves conscious steps of thinking, analysis, prediction, and implementation. Effective decision-making is closely tied to an individual's ability to manage uncertainty and risk. Decision-making is a complex process that occurs through the interaction of cognitive, emotional, and intuitive factors. It requires making a logical evaluation, foreseeing possible outcomes, and making a choice compatible with personal values to achieve the best result in the face of a problem.

Influencing Factors:

- Time Pressure: While making urgent decisions, an individual's emotional reactions and haste can reduce the quality of decisions. Under time pressure, individuals tend to rely on intuitive thinking processes and may overlook in-depth analysis. This can cause decisions to remain superficial and potential risks to be insufficiently evaluated.
- Emotions: Emotional states such as an individual's mood, anxieties, or enthusiasm can distance their decisions from being rational. For instance, an individual may tend to make more optimistic and risky decisions when happy, while acting more cautiously when sad. Emotional intelligence plays a critical role in managing this effect.
- Lack of Information: Decisions made without sufficient information can often be risky and erroneous. An individual may tend to make incorrect generalisations with incomplete data or make decisions based on their prejudices. Access to accurate and reliable information directly increases the quality of the decision-making process.
- Personal Priorities and Values: What an individual deems more important in life directly affects their decisions. For example, prioritising familial responsibilities over work commitments is an example of value-based decision-making. These factors determine the moral and ethical dimension of decisions.

Development Strategies:

- Gaining Awareness: Recognise your personal values, beliefs, and emotional reactions during the decision-making process. Being aware of your own internal state helps prevent emotional influences.
- Evaluating Alternatives: Develop different solution paths and analyse the potential advantages and disadvantages of each. In this process, use your ability to predict possible outcomes.
- Using Time Efficiently: Allocate sufficient time for decision-making and plan for non-urgent situations. Even under time pressure, take short pauses to avoid rushing decisions.
- Conscious Thinking: Do not rush decisions and sift through every option. Review the short and long-term effects of decisions.

Creative Thinking

Creative thinking is the ability to produce new, original, and unconventional ideas. This skill enables individuals to view problems from different perspectives and develop innovative solutions. Creative thinking relies on the individual's capacity to transform knowledge and create new contexts. This skill consists of elements such as "originality" (producing unique ideas), "fluency" (producing a large number of ideas), "flexibility" (producing ideas in different categories), and "elaboration" (concretising ideas). Creative thinking requires the courage to step outside established patterns and explore the unknown.

Influencing Factors:

- Imagination: The ability to explore new possibilities by going beyond reality. For example, imagining using old items with new functions when solving a home decoration problem is a creative approach. Imagination is the primary fuel for creative thinking, expanding the individual's mental boundaries.
- Being Open-Minded: The ability to be sensitive to different ways of thinking and opinions. Accepting ideas from different disciplines in group work increases creativity. Open-mindedness eliminates dogmatism, one of the most significant obstacles to creativity.
- Courage to Take Risks: The courage to try new and unusual paths by overcoming the fear of failure. Trying a new business idea or making a different travel plan requires the courage to take risks. Creativity often requires risk-taking because new ideas may not always be successful.

- Curiosity and Exploration: The desire to deeply examine the world and surrounding events. Curiosity drives individuals to learn and seek innovative solutions continually. Curious individuals tend to see potential opportunities underlying ordinary situations.

Development Strategies:

- Creating an Open-Minded Environment: Establish a non-judgmental classroom environment where students can freely express their ideas.
- Encouraging Curiosity and Exploration: Direct students to think deeply with questions like "Why?", "How?".
- Using Brainstorming Techniques: Encourage producing as many ideas as possible for a problem. For example, organise brainstorming sessions for solution suggestions regarding environmental pollution.
- Gaining Experience with Applied Projects: Enable students to concretise their ideas by giving them real-life oriented projects.

Critical Thinking

Critical thinking is the ability to objectively evaluate knowledge and arguments by thoroughly examining them. This skill enables individuals to draw logical and consistent conclusions, question assumptions, and avoid biases. Critical thinking, as opposed to passively receiving information, denotes an active and inquisitive mental process. In today's world, where information overload is widespread, this skill enables the ability to distinguish between accurate and reliable information. Critical thinking aims to examine the accuracy, reliability, and validity of a subject or situation in detail while analysing it. This process includes fundamental steps such as "analysis", "interpretation", "inference", "evaluation", and "explanation".

Influencing Factors:

- Lack of Information: Insufficient or incorrect information reduces the quality of critical thinking. The individual may tend to make incorrect generalisations with incomplete data. In this case, the critical thinking process should be supported by stages of information gathering and verification.
- Prejudices: Personal beliefs or experiences make objective evaluation difficult. Prejudices can cause an individual to reach a particular conclusion and prevent them from seeing alternatives.
- Time Pressure: Taking quick decisions prevents deep analysis. Under time pressure, individuals generally evaluate information superficially, and the likelihood of making logical errors increases.
- Emotions: Emotional reactions can make logical evaluation difficult. For example, emotions such as anger or fear can cause an individual to display a defensive attitude and disregard opposing views.

Development Strategies:

- Adopting an Inquisitive Approach: Question information by asking "How accurate is this information?", "What evidence is it based on?".
- Discussions and Group Work: Overcome your prejudices and gain a broader perspective by listening to different views.
- Practices of Evaluating Information and Arguments: Analyse arguments presented on a subject and try to identify logical errors.

Communication

Communication is the clear and compelling transmission of thoughts, feelings, and information. This skill is fundamental for resolving disputes, collaborating, and establishing healthy relationships. Communication consists not only of words; it also includes elements such as body language, tone of voice, and facial expressions. Effective communication ensures that the message is received correctly and that a mutual understanding is formed. Communication is a dynamic process consisting of fundamental elements such as "message", "sender", "receiver", "channel", "feedback", and "noise".

Influencing Factors:

- Emotional State: Emotions such as stress, anger, or joy can affect the tone and content of the message. For instance, speaking in an angry tone can cause the message to be misunderstood.
- Body Language: Facial expressions, eye contact, posture, and gestures support verbal communication or can contradict it. For example, nodding while saying "yes" reinforces the message, whereas crossing arms while saying "yes" can create a contradiction.
- Cultural Differences: Communication styles, body language, and perceptions of individuals from different cultures can lead to misunderstandings. For example, direct eye contact is a sign of respect in some cultures, but it can be perceived as a sign of disrespect in others.
- Empathy: The ability to understand the other person's feelings renders communication more constructive and effective. Empathy enables individuals to create an environment of mutual understanding and trust in communication.

Development Strategies:

- Active Listening: Listen to the other party without interrupting, focusing on them, and indicate that you understand. This makes the other person feel valued.
- Communicating Clearly and Distinctly: Express your messages in simple and understandable language. Learn to express your feelings without blaming by using "I language".
- Correct Use of Non-Verbal Communication: Align your body language, tone of voice, and gestures with your verbal message.
- Developing an Empathetic Approach: Try to understand the other party's perspective and give appropriate, supportive responses.

Establishing and Maintaining Interpersonal Relationships

This skill refers to an individual's ability to establish and maintain meaningful, healthy, and long-lasting bonds with others. Trust, empathy, understanding, and open communication are fundamental elements of this skill. Healthy relationships meet the individual's emotional, psychological, and social needs. This skill ensures the individual feels safe and valued in their social environment. Interpersonal relationships form a crucial support system for individuals in coping with life's problems. Establishing healthy relationships reduces an individual's feelings of loneliness and has a positive impact on their psychological health.

Influencing Factors:

- Personality Traits: Personality traits such as extroversion or introversion affect how an individual establishes and maintains new relationships. While extroverted individuals generally make friends more easily, introverted individuals tend to establish deeper and more selective relationships.
- Cultural Differences: Values, communication styles, and societal norms belonging to different cultures can make adapting in relationships difficult. For example, while group decisions are at the forefront in one culture, individual decisions are more valued in another.
- Social Roles: Roles in the individual's family, work, or social environment (parent, employee, friend) determine their behaviours and expectations in relationships. Conflict between roles can create tension in relationships.
- Relationship Dynamics: The balance of power, level of dependence, and conflict management mechanisms in a relationship affect its sustainability. In relationships with healthy dynamics, parties respect each other and contribute equally.

Development Strategies:

- Self-Recognition: Be more conscious in relationships by recognising your own strengths and weaknesses.

- Strengthening Empathy: Increase trust and understanding in relationships by trying to understand others' perspectives.
- Effective Communication: Prevent misunderstandings by using open, kind, and constructive language.
- Building Trust: Reinforce the sense of trust in relationships by keeping your promises and displaying an honest attitude.

Self-Awareness

Self-awareness is the individual's ability to recognise their own feelings, thoughts, values, strengths, and weaknesses, and then direct their life based on this awareness. This skill enables individuals to set realistic goals and cope with challenging situations. Self-awareness enables establishing a bridge between one's inner world and external behaviours. This skill enables individuals to understand their own potential and utilise it effectively. Self-awareness also includes concepts such as "self-consciousness" and "self-efficacy".

Influencing Factors:

- Emotional Awareness: Recognising one's feelings is the first step to understanding oneself. Knowing the source of emotions like anger or anxiety makes managing these emotions easier. Emotional awareness enables individuals to interpret their own internal state accurately.
- Personal Values and Beliefs: Fundamental principles that guide life. These values shape the individual's decisions and goals. For instance, an individual who believes in honesty will be more determined in making ethical decisions.
- Past Experiences: Positive or negative experiences lived affect the individual's belief in themselves and their problem-solving style. While a failure experience can damage an individual's self-confidence, a success experience reinforces it.
- Perception of Self-Efficacy: The belief that one can succeed at a task enables the individual to take responsibility and struggle with difficulties. Individuals with high self-efficacy perception generally set more challenging goals.
- Physical and Mental Health: Good body and mind health ensure the individual focuses better on the self-awareness process. For instance, an individual experiencing chronic fatigue may have difficulty clearly analysing their feelings and thoughts.

Development Strategies:

- Keeping a Journal: Increase self-awareness by writing down reactions to events experienced during the day and feelings felt.
- Value and Belief Analysis: Identify your fundamental values that motivate and guide you.
- Identifying Strengths and Weaknesses: Make an objective evaluation of yourself by receiving feedback and analysing your successes.

Empathy

Empathy is a person trying to understand another's feelings, thoughts, and perspective by putting themselves in their place. Empathy creates mutual understanding, trust, and respect in communication. Empathy is addressed in two dimensions: cognitive and affective. Cognitive empathy is mentally understanding a person's perspective, while affective empathy is the ability to feel that person's emotion. Empathy encompasses not only understanding emotions but also responding appropriately to this understanding.

Influencing Factors:

- Personal Experiences: Having experienced similar situations makes understanding others' feelings easier. For instance, a person who has lost a relative may be more empathetic towards someone grieving.

- Emotional State: The individual's own emotional state affects their capacity to empathise. Intense stress or anxiety can prevent the individual from focusing on others' emotions.
- Social Environment and Cultural Values: The importance given to empathy by family and society determines how the individual develops this skill. In collectivist cultures, empathy may be more valued than in individualistic cultures.
- Physical Distance and Form of Communication: While face-to-face communication supports empathy as it allows catching emotional cues more easily, written communication can make this process difficult.

Development Strategies:

- Developing Awareness: Take the first step to empathising by recognising your own emotions.
- Active Listening: Fully focus on what the other person is saying. Try to understand not just the words but also the tone of voice and body language.
- Trying to Understand Different Perspectives: Try to understand their perspective by putting yourself in someone else's place.

Emotion Management

Emotion management refers to an individual's ability to understand, regulate, and express their own emotions and the emotions of others constructively. This skill plays a critical role in coping with stress and making more balanced decisions. Emotion management enables individuals to control their emotional reactions to internal and external stimuli consciously. Emotional awareness is the prerequisite for emotion management. Managing emotions is not suppressing them, but recognising, accepting, and constructively directing them.

Influencing Factors:

- Level of Self-Awareness: An individual who does not recognise their own emotions has difficulty managing these emotions. Self-awareness is the prerequisite for emotion management.
- Stress and Anxiety Level: High stress makes controlling emotional reactions difficult and increases reactivity. Under stress, the individual's ability to think logically weakens.
- Reflective Thinking: Analysing one's own emotional reactions enables taking more conscious steps in emotion management. For example, taking a moment to reflect on the reasons for anger makes managing this emotion easier in the future.
- Physiology and Health Factors: Insufficient sleep, poor nutrition, or chronic illnesses negatively affect emotional balance. For instance, insomnia can make an individual more irritable and impatient.

Development Strategies:

- Activities for Emotional Awareness: Teach students to recognise their emotions with tools like emotion wheels or journaling.
- Transforming Negative Emotions Constructively: Teach using emotions like anger or disappointment as a source of motivation to work harder or seek solutions.
- Relaxation Techniques: Teach stress-reducing methods such as breathing exercises, meditation, and mindfulness.

Entrepreneurship

Entrepreneurship is the ability to produce innovative ideas, evaluate opportunities, and bring these ideas to life in order to solve problems or meet needs. This skill includes elements such as courage to take risks, creativity, and strategic planning. Entrepreneurship is adopting a proactive and solution-oriented approach to problems encountered in daily life, not just starting a business. Entrepreneurship enables individuals to question the current situation, discover new paths, and create value by utilising resources most efficiently.

Influencing Factors:

- Risk Tolerance: The individual's ability to act courageously in situations containing uncertainty. Individuals with high risk tolerance do not hesitate to try innovative ideas.
- Economic and Physical Conditions: Access to resources, financial situation, and infrastructure affect entrepreneurial activities. While restricted economic conditions encourage creativity, good infrastructure facilitates the implementation of new ideas.
- Motivation Level: The individual's intrinsic and extrinsic motivation determines their determination in the entrepreneurial journey. Intrinsic motivation is the most potent driving force keeping the entrepreneur on track despite difficulties.
- Creative Approach: The ability to produce new and original solutions outside the traditional. Creativity provides a competitive edge to entrepreneurs.
- Networking: The ability to provide information, resources, and support by establishing social and professional relationships. A strong network enables the entrepreneur to access opportunities more easily and cope with difficulties.

Development Strategies:

- Project-Based Learning: Give students projects geared towards real-world problems like recycling or energy saving.
- Game-Based Simulations: Enable students to experience risk-taking and decision-making skills with games like setting up a virtual company.
- Social Entrepreneurship Projects: Encourage students to develop social projects to solve a problem in school or the neighbourhood.
- Workshops and Mentorship Programmes: Guide and inspire students by bringing them together with entrepreneurs.

Teamwork and Collaboration

This skill involves individuals coming together around a common purpose to combine their abilities, knowledge, and resources to achieve a shared goal. Teamwork enables individuals to overcome complex problems they cannot solve alone. This skill creates a synergy greater than the sum of individual efforts. Effective teamwork is built on harmonious communication, mutual trust, and a shared vision. Collaboration enables individuals to develop more comprehensive and creative solutions by combining diverse perspectives and skills.

Influencing Factors:

- Communication: Open, transparent, and continuous communication increases the team's coordination and harmony.
- Trust: Trust of team members in each other and the leader facilitates collaboration.
- Individual Differences: Different personalities, skills, and perspectives can increase the team's creativity but can lead to conflicts if not managed well.
- Leadership: The leader providing motivation, managing conflicts, and coordinating task distribution affects the team's performance.
- Clarity of Goals: The team uniting around a common goal and clearly defining objectives strengthens collaboration.
- Task Distribution and Responsibility: Distributing tasks fairly and in accordance with skills increases efficiency and participation.
- Conflict Management: Constructively resolving differences of opinion or personal conflicts preserves the team's harmony.

- Motivation and Participation: Team members' motivation and active participation in the process increase the effectiveness of collaboration.

Development Strategies:

- Ensuring Effective Communication: Teach constructive communication techniques like active listening and "I language".
- Creating an Environment of Trust: Reinforce the sense of trust by displaying an honest, transparent, and fair approach.
- Determining Common Goals: Create clear and measurable goals with contributions from team members.
- Task Distribution According to Strengths: Ensure everyone takes on tasks suitable for their abilities.
- Developing Conflict Management Skills: Seek constructive solution paths by viewing conflicts as learning opportunities.

Observation and Research

Observation is the process of acquiring information by carefully examining surrounding events. Research is the process of gathering and analysing information to support and deepen the understanding of acquired knowledge. These skills are of critical importance for understanding the root causes of problems. Observation is a first-hand, raw data collection method regarding a problem; research is the process of making sense of this data by comparing it with a broader pool of knowledge. Observation and research are fundamental tools that enable individuals to understand environmental factors and internal processes.

Influencing Factors:

- Attention and Perception Level: The individual's capacity to notice details and make sense of them determines the quality of observation. A high attention level enables the individual to catch environmental cues more easily.
- Access to Information and Resources: The possibility of reaching reliable and accurate resources increases the effectiveness of research. Incomplete resources or incorrect information can jeopardise the accuracy of research results.
- Environmental Conditions: A quiet and orderly environment facilitates observation and research, while noise and chaos negatively affect the process. External factors can prevent the individual from focusing.
- Motivation and Interest Level: The individual's interest in the subject determines the time and energy they will devote to the observation and research process. Motivation drives the individual to conduct more in-depth research.

Development Strategies:

- Attention and Focus Exercises: Increase focus with techniques like meditation and mindfulness.
- Systematising Observation and Research: Teach conducting observation and research processes within a plan.
- Using Accurate and Reliable Sources: Teach students how to evaluate the reliability of information sources.

Taking Responsibility

Taking responsibility involves an individual consciously initiating action, undertaking a duty, or accepting the consequences of a situation. This skill reinforces the individual's sense of having control over their own life. Responsibility is not just completing a task but also standing behind the results of that task. Taking responsibility increases the individual's self-confidence, accountability, and reliability.

Influencing Factors:

- Self-Confidence Level: High self-confidence ensures the individual does not hesitate to take responsibility, whereas low self-confidence can lead to fear of failure.
- Environmental Support and Social Influences: A supportive environment encourages the individual to act courageously in taking responsibility. A critical environment can weaken this skill.
- Nature of the Problem and Perceived Difficulty Level: Perceiving a problem as manageable increases the individual's willingness to take responsibility. If the problem seems too large and complex, the individual may avoid responsibility.
- Motivation and Perception of Success: Believing that taking responsibility will produce positive results increases the individual's motivation. Successes achieved in the past are a source of motivation for future responsibilities.

Development Strategies:

- Starting with Small Steps: Enable students to experience taking responsibility by giving them small tasks that can be easily completed.
- Teaching to Accept Responsibility for Negative Outcomes: Ensure students face consequences by emphasising that mistakes are part of the learning process.
- Being a Role Model: Teachers and families should be role models for students by fulfilling their own responsibilities.

Time Management

Time management is a planning and organisation process that individuals undertake to use the time they possess most efficiently. This skill plays a critical role in reducing stress and achieving goals. Effective time management enhances an individual's sense of control over their life. Effective time management helps establish a work-life balance. This skill includes fundamental steps such as "planning", "prioritising", "organisation", and "evaluation".

Influencing Factors:

- Self-Discipline and Determination: The individual adhering to the plan they prepared determines the effectiveness of time management. Self-discipline helps overcome the habit of procrastination.
- Distractions: External factors such as phones, social media, or noise cause loss of time by breaking focus.
- Urgency and Importance of Tasks: Correctly prioritising tasks ensures efficient use of time. Methods like the Eisenhower matrix are helpful at this point.
- Insufficient Planning: Unrealistic or irregular plans negatively affect time management and create stress.
- Procrastination Behaviour: The habit of delaying work that needs to be done increases time pressure and stress.

Development Strategies:

- Goal Setting and Prioritising: Arrange your tasks according to order of urgency and importance.
- Planning: Create daily, weekly, and monthly timetables.
- Reducing Distractions: Take distractions under control by organising your work environment.
- Coping with Procrastination Behaviour: Reduce the procrastination habit by dividing complex tasks into small parts.

Personal Care

Personal care is the practice an individual regularly performs to protect and improve their physical, mental, and emotional health. This skill enhances an individual's resilience to problems and improves their quality of life. Personal care is an indicator of the respect and care an individual has for themselves.

Healthy habits increase the individual's self-confidence and motivation. Personal care is not limited to hygiene alone; it also encompasses elements such as nutrition, exercise, sleep, and stress management.

Influencing Factors:

- Physical Health Status: Illness or fatigue can disrupt personal care routines. For instance, chronic pain can make regular exercise difficult.
- Mental Health and Stress Level: Stress can lead an individual to neglect their personal care. Mental fatigue can reduce the individual's motivation to spare time for themselves.
- Time Management: Insufficient time management causes an inability to allocate enough time for personal care.
- Social Support and Environmental Factors: A supportive environment ensures the individual pays more attention to their personal care. For example, doing sports together with a friend can increase motivation.
- Economic Situation: Access to personal care products, healthy nutrition, and sports facilities is directly related to economic status.
- Consciousness and Habits: An individual who understands the importance of personal care adopts positive habits in this regard more easily.

Development Strategies:

- Conscious Nutrition: Create a balanced and healthy diet.
- Regular Exercise: Make physical activity a part of your daily routine.
- Stress Management: Teach students breathing exercises and meditation techniques geared towards reducing exam anxiety.

Protecting the Environment and Nature

This skill is displayed by individuals who use natural resources sustainably to prevent environmental problems. This skill reinforces individuals' awareness of social responsibility. Environmental protection is not just an ethical responsibility but also a necessity for the continuity of a healthy life. Understanding the environmental effects of individual actions and making behavioural changes in this direction is the basis of this skill.

Influencing Factors:

- Awareness and Knowledge Level: Individuals unaware of environmental problems have difficulty taking action on this issue. Knowledge enables the individual to understand the importance of environmentally friendly behaviours.
- Personal Values and Attitudes: Valuing environmental sustainability ensures the individual displays environmentally friendly behaviours. For example, a value like respecting nature creates motivation to reduce plastic use.
- Societal Collaboration: Large-scale environmental problems require societal collaboration beyond individual efforts. For example, a recycling programme becomes successful with the community's joint effort.
- Local Environmental Conditions: The climate, geography, and natural resources of the region lived in determine environmental protection strategies. In a region experiencing water scarcity, water conservation is a top priority, while in a forested region, fire prevention efforts take centre stage.
- Political Will: The determination of governments and local administrations regarding environmental protection affects societal efforts. Implementing large-scale environmental projects can be challenging without adequate political support.

Development Strategies:

- Environmental Education Curriculum: Add environmental awareness and sustainability topics to the school programme.
- Project-Based Learning: Give students projects geared towards real-world problems like recycling or energy saving.
- Experiential Education: Ensure students establish direct interaction with the environment through activities like nature walks and environmental cleaning.

Resource Management

Resource management is the skill of reaching goals by using existing resources (time, money, energy, information, etc.) effectively and efficiently. This skill enables individuals to maintain their lives in a more organised and sustainable manner. Resource management provides a strategic approach for effectively utilising limited resources. Effective resource management is fundamental for individual and institutional success.

Influencing Factors:

- Time Management: Inability to plan time correctly causes inefficient use of other resources.
- Financial Situation: Budget constraints necessitate strategic planning in resource use.
- Individual's Knowledge and Skills: Insufficient knowledge can lead to a waste of resources and wrong decisions.
- Motivation and Self-Discipline: The individual's motivation determines the willingness to use resources consciously. Self-discipline ensures the implementation of plans.
- Environmental and External Factors: Economic crises or natural disasters can affect resource management.

Development Strategies:

- Goal Setting: Set clear goals to determine what your resources will be used for.
- Identifying Resources: Take an inventory of all resources you possess (time, money, skills).
- Planning and Prioritising: Allocate your resources by arranging your tasks according to urgency and importance.
- Ensuring Savings and Efficiency: Develop saving habits to prevent resource waste.

Using Information and Communication Technologies

This skill involves individuals acquiring information, communicating, and solving problems by effectively using digital tools and technological systems. Digital literacy is the cornerstone of this skill. This skill ensures that the individual maintains their online presence securely, ethically, and efficiently. Correct and conscious use of technological tools increases the individual's quality of life and prepares them for the modern world. Using information and communication technologies includes sub-components such as "information literacy", "technology literacy", and "digital ethics".

Influencing Factors:

- Digital Literacy: The ability to understand, use digital tools, and access reliable information. Digital literacy enables individuals to evaluate digital content critically.
- Access Opportunities: Internet connection, technological devices, and infrastructure determine the use of this skill. Insufficiency of access opportunities can lead to digital inequality.
- Technological Advancement: The technological infrastructure of a society affects how much efficiency individuals can get from digital tools.
- Technology Anxiety: Stress and fear experienced while using new technologies can prevent the individual from developing this skill.

Development Strategies:

- Digital Literacy Training: Organise training for teachers and students regarding the use of digital tools.
- Practising: Gain experience by making digital tools a part of daily life.
- Learning Ways to Access Reliable Information: Teach students how to question the reliability of online sources.

Health Protection

Health protection encompasses measures intentionally taken by an individual to safeguard and enhance their physical, mental, and emotional well-being. This skill raises the individual's quality of life and helps protect them from diseases. This skill signifies an individual taking responsibility for their own health throughout their life. Healthy habits increase the individual's self-confidence and motivation. This skill includes elements such as "preventive health", "curative health", and "healthy lifestyle".

Influencing Factors:

- Knowledge and Awareness: Possessing sufficient knowledge about the importance of healthy nutrition, hygiene, and exercise shapes the individual's behaviours in these matters.
- Physical Environment: The environment lived in, being hygienic, safe, and healthy, affects the individual's efforts to protect their health.
- Income Level: Access to healthy foods, health services, and sports opportunities is directly related to economic situation.
- Habits and Behaviours: Habits such as regular exercise, adequate sleep, and stress management affect individual health.

Development Strategies:

- Conscious Nutrition: Encourage healthy foods in school canteens and provide nutrition education.
- Regular Exercise: Organise physical activity programmes such as morning sports or sports clubs at school.
- Stress Management: Teach students breathing exercises and meditation techniques geared towards reducing exam anxiety.

Social Contract

The social contract is an understanding where individuals accept forgoing a certain measure of their freedom to ensure order, justice, and cooperation within society. This skill requires social responsibility and empathy. The social contract encompasses both the legal and juridical framework, as well as unwritten rules. This ensures the individual looks after the general interests of the community while protecting their own rights. The social contract establishes a balance between individual freedoms and societal order.

Influencing Factors:

- Individualism and Collectivism: Individualistic and collectivist cultures affect compliance with societal rules and forms of cooperation differently.
- Traditions and Customs: Unwritten rules of society play an important role in ensuring societal order.
- Legal and Juridical Framework: Laws concretise the social contract by defining individuals' rights and responsibilities.
- Economic Conditions: Income inequality can weaken societal order and lead to conflicts.
- Leadership and Authority: A leader displaying fair and transparent management increases trust in the social contract.

Development Strategies:

- Being Aware of Individual Rights and Responsibilities: Teach students to respect others' rights while defending their own.
- Knowing Societal Rules and Norms: Ensure students adopt school rules by creating them together.
- Developing Empathy: Encourage understanding of others' feelings and needs.
- Encouraging Collaboration: Organise group projects and community activities to solve everyday problems.

Personal Development

Personal development is the process by which an individual develops themselves, aiming to discover their own potential, enhance their abilities, and lead a more fulfilling life. This process includes the skill of self-recognition and coping with difficulties. Personal development is a lifelong journey of learning and growth. Personal development strengthens fundamental qualities of the individual, such as "flexibility" (adapting to change), "resilience" (being resistant in the face of difficulties), and "adaptation" (adjusting to new situations).

Influencing Factors:

- Personal Awareness: Self-recognition is the cornerstone of personal development.
- Motivation: Intrinsic and extrinsic motivation ensure the individual is determined in the development journey.
- Mental Resilience: The ability to cope with stress and difficulties accelerates individual development.
- Education and Learning Opportunities: Opportunities to acquire new knowledge and skills ensure the continuity of personal development.
- Experience and Living Conditions: Past experiences and the current environment shape individual development.

Development Strategies:

- Self-Recognition: Enable students to discover themselves with tools like self-evaluation forms and keeping a journal.
- Goal Setting: Teach students to set personal development goals and make plans to reach these goals.
- Continuous Learning: Encourage students to acquire new knowledge by adopting a lifelong learning understanding.
- Feedback and Self-Evaluation: Ensure students follow their own development and improve themselves by receiving feedback.

Conclusion

This study has presented a fundamental analysis of the "Daily Life Problem-Solving Skills" classification developed by Doğan (2025). The findings obtained reveal that the concept of skill is a multidimensional structure shaped by innate predispositions and learning processes. In particular, Doğan's (2025) definition of skill as a dynamic quality developed through continuous learning and application, rather than a passive ability, emphasises why the integration of this skill set into education systems is critical. The Daily Life Problem-Solving Skills model aims to equip individuals with more resilience against the complex and uncertain problems of life, adopting a holistic approach that encompasses not only cognitive but also affective and social aspects.

According to the study's findings, the development of these skills ensures that students transfer theoretical knowledge acquired at school to real-life contexts, rendering learning more meaningful and lasting. When the history of educational programmes is examined, it is seen that the notion that knowledge needs to cease being merely a conceptual whole and become a tool preparing the individual for life has come to the fore. In this context, contrary to traditional approaches that focus on structured problems, it is stated that daily life problems are, by nature, more complex and unstructured. The

solution to such problems requires individuals not only to apply memorised knowledge but also to use deep understanding, situational reasoning, and cognitive flexibility skills.

The twenty different skill areas presented in this scope offer a holistic framework that will ensure individuals are successful at both personal and societal levels. Each of these skills will not only increase the individual's quality of life but will also contribute to societal development and sustainability.

Recommendations

In line with the results of the study, the following recommendations have been developed for educators, policymakers, and relevant researchers:

- Curriculum Integration: The Ministry of National Education (MoNE) and relevant institutions should rearrange curricula based on the "Daily Life Problem-Solving Skills" model. These skills should be integrated into the main structure of all disciplines (especially the Science course), rather than being a topic added at the end of lessons.
- Pedagogical Approach Shift: Instead of rote-learning and output-oriented teaching methods, structured applied pedagogy approaches such as project-based learning, case studies, simulations, and applied workshops should be adopted. In this way, students can internalise theoretical knowledge by experiencing it in concrete contexts.
- Teacher Training: Teacher training programmes and professional development activities should be revised to ensure teachers internalise these skills themselves and teach them effectively in their classrooms. Focus should be particularly placed on developing skills such as creative thinking, critical thinking, and emotional management.
- Development of Assessment Systems: Student success should be measured not only by structured exams but also by alternative measurement and evaluation tools that assess daily life problem-solving skills. These tools should enable students to concretely demonstrate skills such as creativity, critical thinking, and communication.
- Involving the Family in the Process: Awareness-raising activities should be conducted for families to contribute to the development of their children's problem-solving skills. Guides prepared for families can offer information on how to communicate effectively with children and support them in areas such as taking responsibility and time management.
- Future Research: More in-depth quantitative and qualitative research should be conducted on each component of this skill set presented by Doğan (2025). These researchers can examine the development of skills in more detail across different age groups and sociocultural contexts, as well as the factors that affect these skills. In particular, the long-term effects of these skills on the individual's academic success, career performance, and general well-being should be investigated.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" have been complied with, and that we do not take any actions based on the "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, who all contributed to the study, and that all responsibility for any ethical violations rests with the article authors.

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Integrating Artificial Intelligence in STEM Education: Innovations for Transforming Teaching and Learning

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Abstract

The application of Artificial Intelligence (AI) in STEM education presents a major opportunity to transform traditional teaching models and create learning environments that are future-ready. As AI-enabled tools become increasingly accessible, their integration into instruction allows students to engage with scientific materials in new ways and enables educators to plan, implement, and assess learning more effectively. This article explores how AI functions within interdisciplinary STEM contexts to enhance creativity, increase student participation, and promote inquiry-based learning. Drawing on practices from STEM centers focused on teacher education and educational innovation, the study examines how AI and immersive technologies reshape instructional approaches. Prospective teachers are introduced to adaptive learning platforms, virtual laboratories, machine learning-based simulations, and AI-supported assessment tools. When integrated into instructional design, these technologies facilitate personalized feedback, differentiated learning, and more responsive educational environments. The paper also highlights complementary technologies - virtual and augmented reality (VR/AR), 3D printing, and interactive digital platforms - that, together with AI, promote experiential learning that is both immersive and data-informed. Teachers and students engage in interdisciplinary projects where they model scientific processes, create prototypes, and visualize complex systems through virtual simulations. Such hands-on experiences deepen conceptual understanding while strengthening digital competence and confidence in using innovative tools. The educational framework underpinning this paper emphasizes active learning, creativity, and real-world problem solving. Teachers are encouraged to adopt design thinking, support collaboration, and design learning experiences that mirror authentic scientific inquiry. AI acts as a co-facilitator by offering adaptive content and formative assessment, enhancing reflection and personalization in the learning process. Finally, the paper discusses key challenges of AI integration - data privacy, digital equity, ethical concerns, and the evolving role of teachers - concluding that AI should not replace human educators but rather extend their capacity to personalize instruction and foster creativity in STEM classrooms.

Keywords: Artificial Intelligence, STEM Education, Innovative Technologies.

Introduction

The rapid advancement of artificial intelligence (AI) is reshaping how knowledge is generated, accessed, and applied across STEM fields and beyond. In educational contexts, AI now supports adaptive tutoring systems, automated feedback, learning analytics, and synthetic simulation environments that allow learners to engage actively with complex phenomena - rather than passively receive instruction (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019). STEM education - characterized by experimentation, modelling, iterative design, and real-world problem solving - is particularly amenable to AI-enhanced environments. AI can amplify opportunities for students to explore, test, refine, and reflect on scientific processes in ways that were previously constrained by time, resources or safely replicable phenomena. Nevertheless, the integration of AI in STEM education demands more than acquiring tools and platforms. It requires systemic transformation of pedagogy, curriculum design, teacher professional development, infrastructure, ethics, and institutional policy (Holmes et al., 2019; UNESCO, 2021). For example, AI-driven adaptive systems must align with meaningful inquiry strategies; immersive virtual reality (VR) or augmented reality (AR) experiences must be paired with teacher guidance; and 3D printing or maker-based studios must connect to data-driven prototypes. Without careful integration, AI's potential may be under-utilized, misapplied, or even exacerbate inequality (Baker & Hawn, 2022). This article investigates how AI can transform STEM teaching and learning in higher education and teacher education settings as well as in STEM innovation centres. It draws on research over the past decade and synthesises evidence of how AI-enabled personalization, immersive and data-informed learning, and authentic inquiry-oriented tasks can focus in STEM contexts. Key questions addressed include: How can AI support differentiated learning and real-time feedback in STEM classrooms? How can immersive technologies (VR/AR), 3D printing and interactive platforms be aligned with AI to enhance experiential STEM education? What pedagogical, ethical and equity issues emerge as educators adopt AI in STEM centers? In responding to these questions, the contribution of this paper is two-fold: first, it offers a conceptual framework for AI-enabled STEM learning that integrates design thinking, inquiry pedagogy, and maker practices; and second, it provides a practical implementation roadmap for teacher-educators and institutional leaders in STEM centres to engage AI responsibly and effectively. By doing so, the paper situates AI not as a substitute for human educators but as a co-facilitator of inquiry-driven, design-oriented STEM learning environments - where teachers remain central in arranging learning experiences, interpreting analytics, and fostering student agency.

Literature Review

Artificial Intelligence in Education: From Concept to Application

Over the past decade, artificial intelligence (AI) has become increasingly embedded within educational research and practice, leading to the establishment of Artificial Intelligence in Education (AIED) as a multidisciplinary field encompassing computer science, cognitive psychology, learning analytics, and instructional design. Zawacki-Richter et al. (2019) identified intelligent tutoring systems (ITS), adaptive learning environments, predictive analytics, conversational agents, and automated grading systems as the five most researched domains of AI in higher education. Early studies focused primarily on efficiency - reducing teacher workload and offering immediate feedback - but recent work has shifted toward AI's potential to foster creativity, inquiry, and metacognition (Luckin, 2017; Holmes et al., 2019). Intelligent tutoring systems have demonstrated significant positive effects on learning outcomes compared to traditional instruction. A meta-analysis by Kulik and Fletcher (2016) found average effect sizes of 0.66 for ITS interventions, showing that adaptive feedback loops can improve mastery and retention. However, these benefits are not uniform: their impact depends on the quality of instructional design, alignment with curriculum goals, and teacher mediation (Chen, 2009). The teacher's role remains irreplaceable in ensuring that AI systems reinforce rather than constrain human learning processes.

AI-Driven Personalization and Adaptive Learning

During the past decade, artificial intelligence (AI) has become an essential part of modern education. Among its many applications, personalization stands out as one of the most transformative, enabling instruction that adapts to individual learners. Adaptive systems adjust learning sequences, task difficulty,

and feedback timing based on learner profiles and real-time performance data (Holmes et al., 2019). Such systems promote mastery learning, allowing each student to progress at their own pace. Yet scholars caution that personalization can unintentionally narrow the curriculum or reproduce algorithmic bias if data are incomplete or unrepresentative (Baker & Hawn, 2022). Addressing these concerns requires continuous auditing of AI models and cultivating educators' data literacy to interpret system outputs critically (Annuš, 2023). In STEM education, personalization supports differentiated instruction, particularly in mathematics, physics, and computer science. Studies have shown that adaptive learning systems such as ALEKS (Assessment and Learning in Knowledge Spaces) and Knewton, which are well known AI-based educational platforms designed to provide individualized instruction in subjects like mathematics and science, can significantly improve conceptual understanding and student motivation when combined with human feedback (Mousavinasab et al., 2021). AI-driven dashboards also empower teachers to identify misconceptions and adapt lessons dynamically, thus promoting a responsive and student-centered learning environment.

AI and Immersive STEM Learning

AI's integration with immersive technologies - virtual reality (VR), augmented reality (AR), and mixed reality (MR) - has opened new dimensions for experiential learning. Radianti et al. (2020) conducted a systematic review of 38 VR applications in higher education and concluded that immersive simulations can significantly enhance spatial reasoning, procedural understanding, and engagement when supported by pedagogical scaffolds. The Cognitive-Affective Model of Immersive Learning (CAMIL) proposed by Makransky and Petersen (2021) emphasizes that emotional presence, interactivity, and adaptivity are key mediators of learning outcomes in VR environments. When these immersive systems are guided by AI agents capable of responding to learner actions in real time, they create conditions for inquiry-based exploration and reflection. Complementary research highlights how AI supports 3D printing and maker-based education through generative design and optimization algorithms. Ford and Minshall (2019) reported that AI-driven prototyping enables learners to repeatedly test, refine, and enhance their designs, linking data insights with practical outcomes and promoting creativity, engineering thinking, and interdisciplinary collaboration.

Ethical, Legal, and Social Dimensions of AI in STEM Education

The ethical landscape of AI in education is an evolving concern that intersects with data protection, algorithmic transparency, and digital equity. Floridi et al. (2020) proposed seven design principles for AI for social good - fairness, accountability, transparency, privacy, safety, reliability, and sustainability - which have since informed educational frameworks worldwide. UNESCO's AI and Education policy guidelines (2021) further call for human-centered design that ensures teachers maintain agency in pedagogical decision-making. Algorithmic bias remains a substantial risk in AI-supported assessment and predictive analytics (Baker & Hawn, 2022). For example, AI models built on incomplete or unbalanced data can make inaccurate predictions about students from diverse backgrounds or unfairly evaluate nontraditional learning patterns. Equity-oriented research stresses that inclusive datasets, ethical auditing, and participatory design processes involving educators and learners are essential to building trustworthy AI systems (Williamson & Eynon, 2020).

Teacher professional development is also critical. Empirical studies show that even when educators value AI's potential, many feel unprepared to use or critically evaluate AI tools. Teacher education programs should therefore integrate AI literacy modules covering data ethics, algorithmic reasoning, and digital pedagogy, equipping future teachers to act as ethical mediators rather than passive consumers of technology (Annuš, 2023).

Conceptual Gaps and Future Directions

Despite the growing research base, several gaps persist. First, most empirical studies focus on short-term interventions rather than longitudinal impacts on learning and identity formation. Second, cross-disciplinary frameworks integrating AI with design thinking, inquiry-based learning, and maker pedagogy remain underdeveloped. Third, there is limited evidence from teacher education and STEM centers - contexts that play a decisive role in preparing educators for technology-rich environments. This

study responds to these gaps by synthesizing literature and practices to propose a holistic framework for integrating AI into STEM education, emphasizing innovation, ethics, and sustainability.

Method

Research Design

This study adopted a qualitative integrative research design, combining a systematic literature synthesis with an analysis of real practices drawn from STEM centers that focus on teacher education and educational innovation. Integrative reviews are appropriate for complex, evolving fields such as AI in education because they allow for the inclusion of empirical, theoretical, and conceptual sources to generate comprehensive understanding (Whittemore & Knafl, 2005). The goal was to construct a cohesive pedagogical and technological framework that captures how AI integration transforms teaching and learning in STEM contexts.

The research was guided by the following objectives:

1. To identify current applications of AI in STEM education that promote inquiry-based and design-oriented learning.
2. To examine how STEM centers and teacher education programs incorporate AI-enhanced and immersive technologies into instructional design.
3. To propose a model for integrating AI in STEM teaching that balances technological innovation, ethical responsibility, and pedagogical depth.

Data Sources and Selection Criteria

The data corpus consisted of peer-reviewed journal articles, policy papers, institutional reports, and case studies published between 2015 and 2025. Selection was based on relevance to the intersection of AI, STEM, and teacher education. Articles were identified through searches in databases such as Scopus, Web of Science, and ERIC using combinations of the keywords “artificial intelligence,” “STEM education,” “teacher training,” “adaptive learning,” “immersive technology,” and “learning analytics.”

Inclusion criteria were:

• Empirical or conceptual focus on AI implementation in STEM education;
• Discussion of pedagogical models, instructional design, or teacher preparation;
• Publication in peer-reviewed outlets or major international organization reports (e.g., UNESCO, OECD).

Exclusion criteria included purely technical computer-science studies lacking educational context or studies published before 2015, given the rapid evolution of AI since the mid-2010s.

A total of 68 documents met these criteria and were subjected to qualitative coding.

Analytical Procedures

Data were analyzed through thematic synthesis, following the multi-stage approach proposed by Thomas and Harden (2008). First, all sources were imported into NVivo 14 software for open coding, enabling identification of recurring concepts such as personalization, adaptive feedback, AI ethics, immersive learning, and teacher readiness. Second, codes were grouped into higher-order categories that reflected structural relationships - namely:

(a) AI-enabled personalization and feedback;
(b) immersive and inquiry-based environments;
(c) data-driven assessment and analytics; and
(d) ethical, legal, and professional challenges.

Third, a conceptual synthesis was developed that connected these themes to contemporary frameworks for technology integration such as TPACK (Technological Pedagogical Content Knowledge) and SAMR (Substitution, Augmentation, Modification, Redefinition) (Mishra & Koehler, 2006; Puentedura,

2014). To ensure credibility, coding was performed iteratively and triangulated with existing meta-analyses (Mousavinasab et al., 2021). Inter-coder reliability was verified through independent review of 20 percent of coded documents by a secondary researcher affiliated with the South-West University STEM center, achieving 92 percent agreement

Contextual Case Evidence from STEM Centers

In addition to the literature synthesis, the study incorporated practice-based evidence from two STEM centers in Bulgaria involved in teacher training. Institutional documentation, course syllabi, workshop reports, and reflective logs from preservice teachers were examined to understand how AI and immersive tools are being deployed in actual training contexts. These centers serve as living laboratories where adaptive platforms, virtual laboratories, 3D printing, and AI-assisted assessment systems are tested with future educators. The analysis focused on how such environments model AI-enhanced pedagogy and how preservice teachers develop digital competencies through experiential engagement. This "practice lens" grounds theoretical insights in tangible institutional realities and aligns with the design-based research tradition that emphasizes iterative refinement between theory and practice (Barab & Squire, 2004).

Ethical Considerations and Research Integrity

Although this study did not involve human participants, all analyses were conducted in accordance with ethical standards for educational research and institutional guidelines at South-West University "Neofit Rilski." Only publicly available materials were used, and all sources are cited transparently. The study also adheres to the *Higher Education Institutions Scientific Research and Publication Ethics Directive* regarding proper attribution, avoidance of plagiarism, and integrity in reporting. Special attention was given to the ethical implications of using generative AI tools in the preparation of the manuscript. AI-based writing assistance was limited to linguistic refinement and reference management, while all conceptual, analytical, and interpretive work remained under the direct authorship of the researcher, ensuring full accountability and intellectual ownership (Nature Editorial, 2023).

Limitations of the Method

As an integrative synthesis, this research is interpretative rather than experimental. Its findings rely on secondary data and documented practices, which may limit generalizability. Furthermore, rapid technological change implies that the state of AI in STEM education is continually evolving; thus, conclusions should be revisited periodically as new tools and pedagogical models emerge. However, the approach provides comprehensive insights and a coherent framework for practitioners seeking to integrate AI ethically and effectively within STEM teaching and learning.

Findings

The analysis revealed four interconnected thematic domains describing how Artificial Intelligence (AI) transforms teaching and learning in STEM contexts:

(a) adaptive learning and feedback,
(b) immersive and inquiry-based environments,
(c) data-driven design and prototyping, and
(d) learning analytics for formative assessment and reflection.

Each theme contributes to an emerging framework of AI-enhanced inquiry pedagogy that integrates personalization, collaboration, and real-world problem solving.

Adaptive Learning and Feedback

Adaptive learning emerged as the most dominant theme across reviewed studies and practice-based evidence. AI-driven platforms such as ALEKS, Smart Sparrow, Century Tech, and Knewton exemplify how machine learning algorithms can dynamically adjust instructional pathways according to learners' performance, engagement, and cognitive load. Research consistently demonstrates that adaptive systems improve knowledge retention, motivation, and self-efficacy when coupled with teacher facilitation (Holmes et al., 2019). For example, in an experimental study with university engineering students, Chen

(2009) found that personalized AI-driven feedback improved problem-solving efficiency and conceptual understanding in complex tasks. Similarly, AI chatbots and conversational tutors provide instant feedback and emotional support, encouraging metacognitive reflection. In STEM centers focused on teacher education, adaptive learning platforms are used both as teaching aids and reflective instruments. This process helps them learn how to coordinate AI tools with their own teaching decisions, recognizing when to use automated feedback and when direct human support is needed for meaningful learning. However, findings also highlight challenges. Overreliance on automated feedback can reduce student reflection, and opaque algorithmic decisions may limit transparency (Baker & Hawn, 2022). Thus, effective implementation requires explicit teacher mediation and critical dialogue around AI feedback mechanisms.

Immersive and Inquiry-Based Environments

Immersive technologies powered by AI - particularly virtual reality (VR), augmented reality (AR), and mixed reality (MR) - are rapidly transforming experiential learning in STEM education. These environments allow students to conduct virtual experiments, explore molecular structures, or simulate ecological systems that are otherwise impossible to observe directly. AI integration enhances these experiences by providing real-time scaffolding and adaptive simulations. For instance, virtual laboratories equipped with intelligent agents can adjust the complexity of tasks, prompt inquiry questions, and deliver contextualized feedback. In one study, Radianti et al. (2020) reported that AI-supported VR significantly improved spatial reasoning and motivation in engineering education. Similarly, the Cognitive-Affective Model of Immersive Learning (CAMIL) by Makransky and Petersen (2021) shows that adaptivity and emotional engagement are key mediators of effective immersive learning. Evidence from European STEM centers confirms these outcomes. Preservice teachers use VR-based simulations to model chemical reactions or environmental processes, while AI tools track learning patterns to provide formative insights. This combination supports situated cognition - students learn by doing in realistic yet controllable environments (Dede et al., 2017)). Moreover, immersive systems promote empathy and interdisciplinary thinking by visualizing global sustainability problems, linking STEM content to ethical and societal questions.

Data-Driven Design and Prototyping

AI's role in maker education and digital fabrication represents a growing field of innovation. Machine learning algorithms can support generative design, parameter optimization, and automated error detection in 3D printing. Such affordances accelerate the iterative design process, allowing learners to move fluidly between digital and physical prototypes. Ford and Minshall (2019) emphasized that AI-driven design environments bridge computational modeling with tangible experimentation, reinforcing engineering habits of mind such as testing, failure analysis, and refinement. More recent studies highlight the synergy between AI and design thinking frameworks, where data from user testing inform algorithmic adjustments in prototypes. In the observed STEM centers, AI-enhanced prototyping was integrated into problem-based learning (PBL) modules. For instance, preservice teachers designed eco-friendly devices - such as water filtration systems or air-quality sensors - using AI-based simulation tools and printed the final models in 3D. These projects cultivated creativity, teamwork, and sustainable design awareness while strengthening digital literacy. AI also supported assessment of design processes through visual and sensor data analysis. By tracking student interactions, the system generated analytics on collaboration patterns and iteration cycles, which were discussed during debriefing sessions. This reflective feedback loop exemplifies how AI extends the traditional maker model into a data-informed, evidence-based learning ecosystem.

Learning Analytics and Formative Assessment

A central function of AI in STEM education lies in its capacity to generate learning analytics - data visualizations that help teachers and students understand progress, engagement, and conceptual mastery. Learning analytics dashboards (LADs) aggregate behavioral data such as time on task, quiz attempts, and collaboration networks to inform pedagogical decisions. Research indicates that LADs improve teacher situational awareness and facilitate timely interventions (Ifenthaler & Yau, 2020). In the reviewed STEM centers, instructors used analytics to monitor student engagement during laboratory simulations and to personalize feedback. For example, if students struggled with particular variables in

a physics simulation, the AI dashboard recommended targeted exercises and video explanations. However, findings also point to ethical and practical constraints. Without sufficient training, teachers may misinterpret analytics or rely excessively on numerical indicators (Williamson & Eynon, 2020). To mitigate these issues, professional development sessions on data literacy were conducted at both centers, emphasizing critical interpretation of AI insights and alignment with formative assessment principles (Annuš, 2023). When effectively used, AI-based analytics transform assessment from summative measurement to continuous formative feedback, enabling adaptive instruction and learner agency. Students become co-interpreters of their data, reflecting on learning strategies and setting personalized goals (Aldowah et al., 2019).

Synthesis of Findings: Toward a Framework for AI-Enhanced STEM Pedagogy

Synthesizing across the four themes, the study proposes a Framework for AI-Enhanced STEM Learning (FAI-SL) characterized by four interdependent principles:

1. Personalization with Pedagogical Mediation – AI systems adapt to learners while teachers maintain interpretive control.
2. Immersive Inquiry and Design Thinking – Learning environments integrate simulation, experimentation, and prototyping.
3. Ethical and Reflective Practice – Data use and algorithmic decisions are transparent, fair, and inclusive.
4. Analytics for Continuous Improvement – Feedback loops support iterative refinement of both teaching and learning processes.

Together, these findings suggest that AI is not a replacement for educators but a co-facilitator of inquiry-driven, data-informed, and ethically grounded STEM learning ecosystems.

Discussion, Conclusion, and Suggestions

The synthesis of literature and practice confirms that Artificial Intelligence (AI) can meaningfully transform STEM education when pedagogical frameworks emphasize inquiry, collaboration, and ethics. Across adaptive systems, immersive simulations, and maker activities, AI strengthens personalization and deepens engagement - but only when coupled with deliberate teacher mediation.

Pedagogical Implications

AI's greatest contribution lies in its capacity to enhance formative assessment and learner agency. Adaptive platforms provide real-time insights into learners' progress, enabling teachers to differentiate instruction and scaffold complex reasoning (Holmes et al., 2019). Similarly, immersive environments supported by intelligent agents foster inquiry and reflection by situating learning within realistic scientific contexts (Makransky & Petersen, 2021). However, these systems are most effective when teachers maintain interpretive control, ensuring that feedback supports conceptual growth rather than procedural repetition (Luckin, 2017). Teacher education programs, therefore, should not treat AI as a discrete technology but as part of a broader digital pedagogy ecosystem. Preservice teachers must learn to design AI-supported lessons that integrate multiple modalities - simulation, experimentation, data analysis, and creative prototyping. Structured reflection on algorithmic bias, data privacy, and inclusivity should accompany such experiences, aligning technical fluency with ethical awareness (Floridi et al., 2020).

Institutional and Policy Considerations

At the institutional level, STEM centers play a pivotal role in modeling responsible AI integration. Findings indicate that infrastructure investment must go hand in hand with capacity building. Teacher educators need training in data literacy, prompt design for generative AI, and strategies for managing effective collaboration between humans and AI systems. Policymakers should promote transparent procurement frameworks that require open algorithmic documentation, privacy-by-design principles, and equitable access to AI tools (UNESCO, 2021). Ethical governance mechanisms are equally essential. Institutions should adopt codes of conduct and auditing procedures ensuring that AI use respects autonomy, fairness, and accountability - values articulated in the EU Ethics Guidelines for

Trustworthy AI (European Commission, 2019). Embedding these principles into teacher preparation ensures that educators can critically assess the social implications of AI while leveraging its benefits for innovation and inclusion.

Future Directions

Despite rapid progress, empirical evidence on long-term learning outcomes and teacher identity formation in AI-mediated contexts remains limited. Future research should combine design-based and longitudinal studies to examine how AI affects collaboration, creativity, and problem-solving across diverse STEM disciplines. Mixed-methods approaches that integrate quantitative performance data with qualitative classroom observations will help clarify how and why AI interventions succeed or fail (Ifenthaler & Yau, 2020). International collaboration among STEM centers can further accelerate innovation by sharing open resources, case studies, and evaluation tools. The creation of a transnational network for AI and STEM teacher education - linking European and global institutions - would promote knowledge exchange and alignment with sustainable development goals related to quality education and innovation.

Conclusion

AI should not be viewed as an autonomous substitute for human teaching but as a co-facilitator that augments inquiry, creativity, and personalization in STEM learning. When implemented ethically and pedagogically, it empowers both teachers and students to engage in reflective, data-informed, and socially responsible scientific exploration. The key challenge is balance: integrating automation without diminishing human judgment, and embracing innovation while safeguarding equity and integrity. As STEM education continues to evolve, cultivating educators who are critically literate in AI will be indispensable for shaping learning environments that are intelligent, inclusive, and future-ready.

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Negative Features of the University Students' Use of Artificial Intelligence – Socio-Pedagogical Aspect

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Abstract

Connecting the negative features of the use of artificial intelligence understood as risky behaviours with the student population viewed through the prism of social pedagogy opens up important perspectives. In the context of artificial intelligence, the focus is on how its use can lead to dysfunctional behavioural patterns in students and how social pedagogy can be positioned towards these challenges. Accordingly, the aim of the research was to investigate certain negative features of the use of artificial intelligence by university students in the form of risky behaviours, i.e., considering the social pedagogical aspect**.**

The research involved students of the University undergraduate study of Early and Preschool Education, Faculty of Educational Sciences, Juraj Dobrila University in Pula, Croatia. The qualitative research used a semi-structured interview designed for the purpose of conducting this research.

The findings showed that the negative features of the use of artificial intelligence by students can be grouped into three categories, which include academic disrespect, psychological and social risks, and security and ethical challenges. A more detailed analysis of the responses showed that the discourse of students in the observed categories was related to a lack of autonomy and responsibility, reduced critical thinking and avoidance of independent learning, reduced social interaction and isolation, distorted self-image and reduced self-esteem, anxiety, addiction, unethical decision-making, unequal access, failure to protect personal data and the spread of disinformation.

The article contributes to the recognition of artificial intelligence as a potential source of specific risky behaviours and thus consequently enables proactive action to create a more ethical and supportive academic environment. Higher education institutions should develop clear policies and guidelines for the use of artificial intelligence in an academic context, educating students about the consequences of violating these rules even before the problem arises.

Keywords: Artificial intelligence, ethical and security challenges, psychological and social risks, risks to academic and professional success, university students.

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Introduction

Linking the negative features of the use of artificial intelligence as risky behaviour with the student population, viewed through the prism of social pedagogy, opens up important perspectives. Social pedagogy deals, among other things, with socially unacceptable forms of behaviour with the aim of promoting optimal development and social integration of the individual. In the context of artificial intelligence, the focus is on how its use can lead to dysfunctional behavioural patterns in students and how social pedagogy can address these challenges. Moreover, linking artificial intelligence as risky behaviour with the student population is an extremely relevant and complex topic. There are several key areas where the use of AI tools by students can be considered risky behaviour with potential negative consequences for academic success, mental health and skill development, and thus for later professional success.

Following the above, the aim of the research was to investigate certain negative features of the use of artificial intelligence by university students in the form of risky behaviours, i.e., considering the socio-pedagogical aspect.

In accordance with the aim, the following research questions were asked:

1. What is the purpose of my using artificial intelligence knowing that certain activities are not in line with ethical values?

2. How do I feel knowing that I am doing something illegal?

The study introduces a novel perspective by linking the negative features of the use of artificial intelligence, specifically identifying it as a potential source of specific risky behaviors, directly within the student population. In this context, the research methodology used provides a deep insight into the background of these problematic behaviors, which significantly contributes to existing knowledge by enabling proactive strategies to mitigate and foster a more ethical and supportive academic environment.

Literature Review

The term behavioural problems, which is used in literature regarding social pedagogy, refers to a continuum of behaviours: from risky, through behavioural difficulties to behavioural disorders which are seen as the highest level of harm and danger for the young and their environment (Koller-Trbović, Žižak, and Jeđud Borić, 2011). The characteristics of behavioural problems in children and young people are their complexity and harm, while constant variability becomes a characteristic related to various social changes. For this reason, definitions of behavioural problems include a combination of multiple characteristics in different environments, which most often include certain deviations and make it difficult for the young person to function on a daily basis, which consequently negatively affects the individual and their environment. These are behaviours that deviate from the usual standards or norms that apply to a child of a certain age in a certain social environment, and which that environment, due to possible consequences for the child and/or the environment, assesses as harmful and/or dangerous and therefore requires special treatment. On the continuum of behavioural patterns, the movement of these problems is visible from simpler, less severe and dangerous to oneself or others, to forms of behaviour that are sanctioned by regulations, have more serious consequences and indicate the need for treatment (Bouillet, and Uzelac, 2007, Koller-Trbović et al., 2011).

In the context of the increasing application of artificial intelligence, the Council of the EU (2018) emphasizes that the way in which artificial intelligence is currently approached will define the future of the world. The above places a great obligation and responsibility, but also challenges, before responsible citizens. In a negative sense, it is assumed (UNESCO, 2020) that, when it comes to artificial intelligence, potentially built-in prejudices could lead to inequality, exclusivity, threats to cultural, social and ecological diversity, and social or economic divisions. Some authors believe that in the educational environment (Göçen, and Aydemir, 2020, as cited in Mrnjaus, Vrcelj, and Kušić, 2023) the unregulated and irrational use of artificial intelligence could lead to ethical, security, pedagogical, psychological and sociological problems. At the same time, as the main risks of using artificial intelligence many authors state plagiarism, copyright infringement, misinformation, distortion of critical and creative thinking, reduction of writing skills... (Compilatio.net, 2023, Qadir, 2023, Vieriu, and Petrea, 2025). i.e. those are

key areas where the use of artificial intelligence by university students can be considered risky behaviour with potential negative consequences. In this sense, Holmes and Tuomi (2022) point out that higher education institutions must clearly define the role and extent of artificial intelligence in university student education to address mentioned challenges effectively.

Method

Research model

This is a qualitative research study. The semi-structured interview that was applied is a combination of a structured and unstructured interview. In the semi-structured interview, the interviewer had a general framework of topics that he needed to explore, but the questions were not strictly specified and were adjusted as necessary, directed by the interlocutor.

Framework analysis (Richie, and Spencer 1994, as cited in Lacey, and Luff, 2007) was used as a procedure for qualitative data analysis, and it included five related phases (I - familiarization with the material, II - setting the thematic framework, III - coding of respondents' statements and grouping based on similarities. IV - table presentation and V - connection and interpretation of findings).

Research respondents

The research involved 27 respondents, students of the University undergraduate study of Early and Preschool Education, Faculty of Educational Sciences, Juraj Dobrila University in Pula, Croatia. The sample of respondents was convenient.

Data processing

The research used a semi-structured interview designed for the purpose of conducting this research. The interview consisted of 10 questions, and covered topics related to the academic environment and the application of artificial intelligence in that environment, the psychological and social risks of using artificial intelligence, and the ethical and security challenges of using artificial intelligence. In this case, responses that related to negative features were considered.

Ethical standards were respected in the research, while participation was voluntary with the possibility of withdrawal at any time. Confidentiality of the data was guaranteed, no names of respondents were used neither published anywhere.

Limitations

The limitations in the research that require caution in drawing conclusions are primarily the convenience sample of respondents, which consisted exclusively of female respondents, and the possibility of giving desirable answers given the research environment (faculty). Also, not all answers have the same weight in terms of complexity, but also frequency, which indicates the possible need to verify the findings using quantitative methods.

Findings

Almost all respondents reported using artificial inteligence to copy and thus plagiarize term papers and other assignments in an academic environment. Examples of responses that included academic disrespect were: “I use it for term papers and essay writing, regularly lately”, “I use it for term papers and sometimes look up for answers to exam questions”.

Lack of autonomy and responsibility, but also a reduction in critical thinking and avoidance of independent learning included the answers: "I don't have to try hard or think too much, and I get the solution right away", "I have more time for other activities, I get the answer quickly, I don't need to think and waste time on the meaning" "Everything just goes much faster" "The answer is there in an instant, I don't have to read anything, or look for it specifically".

Psychological and social risks are visible in the answers: "I don't feel sure that the seminar paper will be good if I write it myself", "I think it would be more accurate if an artificial intelligence wrote the answer for me, in fact, it is certain that the paper will turn out better", "Sometimes it seems to me that I spend more time talking to artificial intelligence than with my friends".

The risks of addictive behaviour are also evident from the answers: “When I start a conversation, I have a hard time breaking away from my cell phone”, “I spend a lot of time talking to artificial intelligence and I do it every day”.

The lack of clear responsibility in the form of ethical issues is reflected in the avoidance of taking responsibility and unequal access, i.e. access to advanced and paid tools by certain students: “I know that this is not allowed, but it makes my homework much easier”, “I hope that no one will realize that I did not write the assignment myself, and that is usually the case”, “I know that there are several types of artificial intelligence, better and worse, and probably the ones with a subscription solve the task better. Although it is worse, it certainly solves it better than me”, “I have a subscription to a better version, so I am more confident that I will not be caught copying”. “It is not my fault that they invented this to help us, so since it already exists, I use it”, “I know that some answers are probably not completely correct, but they are certainly more accurate than mine when I am not studying”.

Security challenges are visible from the answers. "I always enter all the data if necessary, just to get the answer,...I know that all the data is visible and that what I'm reviewing in artificial intelligence can be seen, but I still do it anyway because I urgently need an answer.", "To use and retell the information obtained by artificial intelligence as if it were accurate," "I trust artificial intelligence, 99.9%."

Based on the conducted interview, categories were defined based on the content similarity of the questions asked in the interview, while dimensions and discourses were obtained based on the content of the respondents' answers (Table 1).

Table 1.
Negative features of the use of artificial intelligence by students

Categories	Dimensions and discourses
Academic dishonesty	• academic disrespect (copying and plagiarism) • lack of autonomy and responsibility • reduced critical thinking and avoidance of independent learning
Psychological and social risks	• reduction of social interaction and isolation • disturbance of self-image and reduced self-esteem • anxiety • addiction
Ethical and security challenges	• unethical decision-making • unequal access • failure to protect personal data • spreading misinformation

Discussion

The findings showed that respondents, in a negative sense, overly rely on AI tools, which indicates academic dishonesty that directly violates academic integrity. Firstly, this concerns copying and plagiarism for writing essays, term papers and other assignments, as well as answers to exam questions

which is also evident from other research (Qadir, 2023, Vieriu, and Petrea, 2025). Social pedagogy, which strives to develop responsible individuals, recognizes copying, plagiarism and overreliance on artificial intelligence as a violation of ethical norms.

Based on the findings of the interviews, a lack of autonomy and responsibility of students is visible. Namely, the social-pedagogical approach encourages the development of autonomy and taking responsibility for one's own learning. When students use AI to avoid independent thinking and problem solving, this indicates a lack of developed self-regulation skills and responsibility for one's own educational process. This behaviour may be an indicator of deeper problems with motivation, anxiety or lack of resources. This is confirmed by Crowe et al. (2017 as cited in Mrnjaus et. al., 2023) who state that students who use artificial intelligence to generate papers without their own input demonstrate a lack of responsibility and honesty, which is considered problematic behaviour. In addition, artificial intelligence can encourage dishonesty and threaten academic integrity.

Also, when using and relying on artificial intelligence, the respondents' discourse shows that there is a decrease in reliance on one's own cognitive abilities. Consequently, the development of skills of analysis, synthesis, critical evaluation of information and independent research is lacking, which in the long run can make students less capable of complex problem solving. Students invest less time and effort in understanding the material without deeper acquisition of knowledge.

Furthermore, based on the obtained indicators, a kind of social isolation and reduced interaction of the student is visible. Overreliance on artificial intelligence may reduce students' need for social interaction with peers and professors. Social pedagogy emphasizes the importance of social integration and the development of interpersonal skills. If artificial intelligence replaces social contacts, it can lead to isolation and difficulties in developing the skills necessary for successful social integration. If students increasingly interactwith AI chatbots or assistants instead of people, it can negatively affect the development of their social skills, empathy and interpersonal communication skills. Hu, Mao, and Kim (2023) states that the above can lead to a loss of self-confidence in solving problems, impair social interactions and even isolation from the real world. This especially applies to excessive reliance on AI chatbots for emotional support. Moreover, the research findings reported by Yao, Qi, Sheng, Sun, and Zhang (2025) show that users with low self-esteem are more prone to problem behaviour when using AI chatbots. They assume that this relationship is mediated by, among other things, social anxiety and escapism.

In addition, constant comparison with the "perfect" answers of artificial intelligence can cause students to feel inadequacy, anxiety and reduced self-confidence, and therefore they very easily give up on solving tasks independently. Namely, the ease with which artificial intelligence can generate certain solutions can create unrealistic expectations among students regarding their own productivity and quality of work. Social pedagogy is concerned with promoting mental health and a positive self-image, and such pressure can lead to the development of behavioural disorders related to anxiety or depression and other internalized behavioural disorders. In this sense, students may feel incapable of performing tasks without the help of artificial intelligence, which can lead to compulsive behaviour. Also, research (Tufail. Shahwani, Khan, and Badar, 2024) has confirmed correlations between exposure to content generated by artificial intelligence, self-esteem and, for example, satisfaction with body image, with social comparison appearing as a key mediator in these relationships.

As with the application of digital technology in general, there is a risk of excessive use or addiction when using artificial intelligence. Social pedagogy recognizes addictions as risky behaviours that impair the quality of life and functionality of an individual.

Responsibility and ethical decision-making related to the use of artificial intelligence was absent from the students' discourse. Students do not assume and do not recognize clear personal responsibility for their actions. This can lead to avoiding taking responsibility and makes it difficult to correct possible injustices. Based on the answers, it can be concluded that students do not understand the ethical implications of using this system and that they do not recognize situations in which personal responsibility is present. This raises the question of compliance with social values and norms in terms of tacitly allowing such types of behaviour.

In the context of ethical and security challenges, unequal access and a kind of digital divide are evident in the responses of the observed students. Namely, quality AI tools may require a subscription or specific equipment. This can deepen existing inequalities among students, where those with better access to technology have a certain "advantage" in education.

In addition, students uncritically accept and further expand information generated by artificial intelligence that may be biased or inaccurate, which represents risky behaviour in terms of information integrity and responsibility to the community. Namely, AI models are trained on huge amounts of data, which may contain inherent biases. Students may internalize these biases or be exposed to misinformation. This calls into question their ability to distinguish accurate from inaccurate information. Authors such as Schaeffer, Coombs, Luckett. Marin, and Olson (2024) state that the risks of using AI applications in higher education are great, especially when it comes to the stated risks of bias.

From the aspect of data security and protection, it is evident that students agree to provide personal data and do not sufficiently recognize potential threats. This poses significant security challenges related to privacy and data protection, which is actually considered irresponsible behaviour. In this sense, the socio-pedagogical approach promotes responsible behaviour in the digital environment, which includes understanding the right to privacy and ethical obligations when using digital tools. Plantak, Vargović, and Trstenjak (2023) state that artificial intelligence systems are becoming increasingly sophisticated and capable of processing huge amounts of data, thus increasing the risk that personal data will be misused. This may include data breaches, unauthorized surveillance, or the use of personal data to discriminate against individuals or groups.

Conclusion, and Suggestions

Connecting the negative features of the use of artificial intelligence as risky behaviours with the student population refers to the recognition and mitigation of potential negative consequences. It is not just about the use of technology per se, but the way students use it and the academic, psychosocial, ethical and safety implications of such use. Institutions of higher education, teachers and students themselves must actively work to develop digital literacy, ethical guidelines and strategies that promote a responsible and productive use of artificial intelligence while protecting academic integrity, mental health, ethical and safety standards.

The socio-pedagogical approach offers a framework for prevention and intervention in relation to these problems, most commonly when it comes to education and increasing digital literacy, which includes developing programs that educate students about the (ethical) use of artificial intelligence, risks and potential pitfalls. This includes learning about the biases of artificial intelligence, privacy protection and the importance of critical evaluation of information. The focus should be placed on the development of social skills, i.e., promoting activities that encourage social interaction, cooperation and communication among students. University counselling centres can provide psychological support to students who struggle with anxiety, pressure or feelings of inadequacy due to the use of this tool. Higher education institutions should develop clear policies and guidelines for the use of artificial intelligence in an academic context, educating students about the consequences of violating these rules even before the problem arises. Recognizing artificial intelligence as a potential source of specific risky behaviours allows for proactive action to create a more ethical and supportive academic environment.

Acknowledgment

Ethics statement: In this study, I declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that I do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, I declare that all the responsibility belongs to the article author in case of all ethical violations.

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A Systematic Review of Studies on the Implementation of Robotics and Coding Applications in Science Education

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Abstract

With the advancements in technology and the emergence of Industry 4.0, enriching science education environments with robotics and coding applications has gained increasing importance in recent years. In this context, integrating robotics and coding applications into science instruction is recommended. This study aims to systematically review research conducted between 2015 and 2025 that incorporates robotics and coding applications in science education. A comprehensive search was conducted across Web of Science (WoS), Google Scholar, ProQuest, ERIC, TRDizin, and YÖKTEZ databases using the keywords "robotics," "coding," and "science education." Based on the inclusion criteria, 47 full-text accessible studies were selected for in-depth analysis. The studies were examined based on database source, publication year, types of robot kits used, sample level, sample size, research method, data collection tools, and dependent variables. The findings were presented descriptively. According to the databases, data from 19 studies in WoS, 15 in Google Scholar, 3 in ERIC, 4 in TRDizin, 4 in YÖKTEZ, and 2 in ProQuest were reviewed. The year 2024 was identified as the most prolific in terms of publication frequency. Among the robot kits used, Arduino sets were the most preferred due to their ease of use. Since the inclusion criteria focused on science education, middle school students were predominantly represented in the sample populations. The majority of studies involved 11 to 30 participants. Regarding research methods, 15 qualitative, 14 quantitative, and 14 mixed-method studies were identified. In terms of data collection tools, scales were most commonly used in quantitative studies, while interview forms were frequently employed in qualitative research. The dependent variables explored included skills, attitudes, achievement, motivation, opinions, scientific creativity, learning outcomes, and mental imagery. This study aims to contribute to the literature by identifying trends in the integration of robotics and coding in science education. Based on the findings, it is recommended that future reviews include additional criteria to better capture the current state of robotics and coding applications in the field.

Keywords: Science education, coding, robotics, systematic review

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Introduction

Among the aims of science education are seeking solutions to real-life problems, fostering scientific literacy, responding to the demands of the age for digital competence, and educating individuals equipped with 21st-century skills (Güven et al., 2023). While technology-based learning environments are increasingly seen as essential in science teaching, it is observed that studies on educational robotics in Türkiye remain relatively limited. The use of robotics in education appears more frequently in practices implemented in private schools, and it is recommended that robotic coding activities be developed and disseminated in all schools (Büyük, 2015). Although robotics and coding have become widely encountered contemporary concepts their systematic and widespread integration into formal education is still in progress (Atila et al., 2023). Through robotic coding applications, students are encouraged to use computational thinking processes such as algorithmic thinking, logical reasoning, and evaluation to construct and make sense of knowledge.

These applications also ensure that students remain active throughout the learning process, thereby positively influencing their affective characteristics such as interest, attitude, and motivation toward the course (Guven, 2021).

Robotic coding practices are considered important within the education system in terms of educating individuals equipped with 21st-century skills and fostering positive affective dispositions—such as interest, attitude, and motivation—toward science courses (Guven, 2021). With the increase in digitalization, the need to integrate technological resources into the curriculum has become more evident (García-Tudela et al., 2023). To this end, simulations, Web 2.0 tools, QR code applications, virtual reality (VR), 3D printers, digital games, robotic coding, and Arduino-based activities are used in science teaching (Güven et al., 2023). By enabling students to take an active role in the learning process and to learn by doing and experiencing, these practices can be described as an innovative pathway aligned with constructivist learning (Koray et al., 2022). In recent years, there has been a noticeable increase in the use of Arduino applications in science education, particularly for supporting problem solving and encouraging students to develop original designs (Turhal et al., 2024).

In this context, determining the current state of robotics and coding applications in the teaching of Science courses and revealing the trends in robotic coding studies will contribute to the literature. This study systematically examines research conducted between 2015 and 2025 and presents the trends in robotics and coding applications in science teaching from a holistic perspective. The findings are expected to identify gaps in the existing literature and to guide both researchers and curriculum development processes.

Literature Review

Due to the relatively low performance in PISA (Programme for International Student Assessment) and TIMSS (Trends in International Mathematics and Science Study) results and Türkiye's position below the OECD (Organisation for Economic Co-Operation and Development) average, educators have sought to enrich learning environments through new instructional approaches (Meço et al., 2021). With the increase in studies on STEM education in Türkiye, the necessity of incorporating technology-related practices into education from early ages has become evident (Aydemir Samuk, 2025). One of the ways of using technology in education is through robotic coding applications. In recent years, robotics and coding activities have come to occupy an important place among technological developments that shape science teaching processes (Koray et al., 2022).

Today, the rapid advancement of technology, the widespread use of the internet, and the increased use of mobile devices mean that individuals are almost constantly in contact with technological tools in their daily lives. This situation may lead to difficulties in maintaining long-term focus in traditional learning environments, which in turn creates a need to integrate technology into educational settings (García-Tudela et al., 2023). Using robotic coding activities in science courses can enrich the course content, make science lessons more engaging for students, and help extend their attention spans (Coşkunserçe, 2021). Furthermore, integrating robotics and coding applications into the education system is considered important for educating individuals who possess the competencies required by Industry 4.0 (Bayburt et al., 2021).

Robotics and Coding in Education

Robotics

The concept of robotics was first introduced in the 1940s by Isaac Asimov to explain the functioning of robots. Today, robotic technologies are used in many fields such as medicine, the military, education, transportation, agriculture and livestock, and engineering. The emergence of robotics applications in education dates back to the 1980s. Robotics and coding practices, which now have a wide range of applications in education, are used as teaching tools integrated with STEM (Science, Technology, Engineering, Mathematics) (Talan, 2020). In recent years, the use of block-based robots in science education has become increasingly common.

Robots are defined as tools that perceive their environment through sensors, are programmed via microcontrollers, and carry out various commands accordingly. Through educational robots used in science teaching, students develop solutions to real-life problems, and abstract concepts that are otherwise difficult to understand can be explained by means of tangible objects. Robotic coding applications help students develop algorithmic thinking, collaboration, problem-solving, critical thinking, engineering design skills, self-discovery of talents, and the ability to use technology effectively (Guven et al., 2022).

Coding

Coding practices, which began in the United States, have spread to many countries around the world to be implemented in education as a result of technological advances and the evolution of Industry 4.0. Coding can be defined as giving computers sets of instructions so that a designed task can be executed. Coding, which consists of commands written for mechanical systems to perform specific operations, is generally divided into two types: block-based and text-based coding (Yayla Eskici et al., 2020). In science teaching, block-based coding is more frequently preferred (Güven et al., 2023). Because it is easier for students to understand and apply, practitioners also tend to prefer block-based coding more often.

Block-based coding is effective in developing 21st-century skills such as algorithmic thinking, problem solving, inquiry, and creativity (Guven et al., 2022). Many countries across the world have updated their secondary education curricula to include robotic coding education. Among the countries that have integrated such practices into their school curricula are Austria, Estonia, Ireland, Malta, Bulgaria, the United Kingdom, Spain, the Czech Republic, France, Slovakia, Portugal, Denmark, Hungary, Finland, Lithuania and Poland (Kanbul et al., 2017).

In Türkiye, coding education has been taught as a compulsory component of the Information Technologies and Software course for 5th and 6th grades since 2013 (Yayla Eskici et al., 2020). Since 2014, Türkiye has also participated in the EU Code Week. To popularize coding, platforms such as Code.org, Code Academy and CodeClub have been used (Karataş, 2021).

Educational Robotics Kits Used by Age Group

Educational robotics kits used in different age groups include BeeBot, Lego Mindstorms (NXT, EV3, WeDo), Makeblock (mBot), Arduino, and 3D printers, among others (Talan, 2020). Due to its block-based drag-and-drop, puzzle-like coding structure and ease of use and comprehension, Arduino is one of the most preferred microcontroller platforms in science teaching studies (Güven et al., 2023). Arduino is an open-source platform that allows codes stored in its libraries to be combined and executed. Through Arduino applications, students can build models that they can see and touch, and whose reactions they can control via the codes they create.

BeeBot:

BeeBot is a robotics education set that includes the simplest form of coding. It enables children to learn various concepts such as colors, numbers, countries, cities, planets, and letters through coding activities. It is designed for preschool-aged children.

Lego Mindstorms WeDo:

The Lego Mindstorms WeDo set combines Lego bricks with robotics and coding skills. It allows the creation of multiple projects using the Scratch platform. Owing to its illustrated coding booklets, it is recommended for children aged 6–9 years.

Lego Mindstorms EV3:

The Lego Mindstorms EV3 set has been in use since 2013. It is a robotics education set that includes programmable technical parts and various sensors (ultrasonic, touch, color sensor). It utilizes block-based programming and is suitable for children aged 8 and above (Sarikavak, 2023).

Lego Mindstorms NXT:

The Lego Mindstorms NXT set was made available in 2006 through collaboration between researchers at the Massachusetts Institute of Technology (MIT) and the Lego company. Robots built with various sensors such as sound, light and distance sensors can perform different tasks. It is recommended for children aged 11 and above (Büyük, 2015).

Arduino:

Arduino is an open-source platform that was first developed in 2005 as a microcontroller board by Italian graduate students. With a simple microcontroller circuit, Arduino is widely used with mBlock coding based on the C/C++ programming language (Koray et al., 2022). Among robotics coding education sets, Arduino kits are relatively more economical (Koparan Taylan et al., 2021). The Arduino microcontroller can be coded using drag-and-drop blocks, the process can be monitored, and in this way students can also gain basic coding skills (Atila et al., 2023).

Aim of the Study

The aim of this study is to systematically examine, according to predetermined criteria, the studies conducted between 2015 and 2025 that include robotics and coding applications in the teaching of Science courses, and to determine the current state of these studies in the literature related to science education.

In line with this aim, answers to the following research questions are sought:

1. How are the studies distributed according to the databases in which they are indexed?
2. How are the studies distributed by year?
3. What is the distribution of robotic sets used in robotic coding applications?
4. How are the sample levels distributed?
5. What are the sample sizes?
6. Which research methods are used?
7. Which data collection techniques are employed?

Method

A systematic literature review is not a traditional narrative review; rather, it is an independent research methodology that involves identifying, evaluating, and interpreting all accessible studies related to a specific research question, subject area, or phenomenon of interest (Denyer & Tranfield, 2009). Systematic reviews enable the interpretation of existing research on a particular topic by synthesizing findings across studies. By comparing the results of studies conducted in a given field, systematic literature reviews support a comprehensive and holistic

Inclusion Criteria

In this study, which focuses on Arduino-based robotics and coding applications in science education, studies outside the scope of science courses were excluded during the screening process. The inclusion criteria for the studies incorporated into the review were as follows:

- Published between 2015 and 2025,
- Focused on robotics and coding applications in the teaching of science courses,
- Accessible in full-text format online,

- Indexed in Web of Science (WoS), Google Scholar, ProQuest, ERIC, TRDizin, or YÖKTEZ,
- Conducted with middle school students, science teachers, or prospective science teachers and containing robotics and coding implementations relevant to science education.

Data Collection

During the data collection process, an initial total of **83 studies** were identified. As the review specifically examined robotics and coding applications within the context of science education, **36 studies were excluded**, leaving **47 studies** that met all inclusion criteria. Among the reviewed studies, **two master's theses** and **two doctoral dissertations** were included.

Data Analysis

The data collected in accordance with the study's purpose and predetermined criteria were analyzed descriptively. Each study was systematically examined based on the following characteristics:

- Database of publication,
- Distribution of studies by publication year,
- Types of robotic kits used,
- Sample (participant) level,
- Sample size
- Research method,
- Data collection techniques, Dependent variables investigated.

The findings were then presented using descriptive statistics and narrative synthesis.

Validity and Reliability

- Reliability was ensured by adhering to clearly defined inclusion criteria and applying them consistently during the screening process. To ensure internal reliability and consistency, two authors independently reviewed and discussed the data analysis until **100% agreement** was reached.
- For validity, the review included only studies that were openly accessible, met the inclusion criteria, and aligned explicitly with the coded themes and categories. This ensured that all examined articles were relevant, verifiable, and suitable for systematic analysis.

Findings

The findings obtained from the analysis of studies involving robotics and coding applications in science education are presented below.

Distribution of Studies by Database

Within the scope of this review, a total of 47 studies were examined in full text across the following databases: *Web of Science (WoS), Google Scholar, ProQuest, ERIC, TRDizin,* and *YÖKTEZ* (including two master's theses and two doctoral dissertations). The distribution of the studies by database is presented in Table 1.Among the reviewed works, 43 were journal articles and 4 were graduate theses, indicating that the majority of the research in this field has been disseminated through peer-reviewed journal publications.

Table 1.
Distribution of Studies by Database

Veri Tabanı Adı	Makale	Tez
WoS	19	-
Google Akademik	15	-
ERIC	3	-

TR Dizin	4	-
YÖKTEZ	-	4
ProQuest	2	-

Among the 43 journal articles examined, the highest number was found in the Web of Science (WoS) database (n = 19), followed by Google Scholar (n = 15). In addition, four theses accessed through the YÖKTEZ database were included in the review.

Distribution of Studies by Year

The distribution of the studies by publication year is presented in Figure 1.

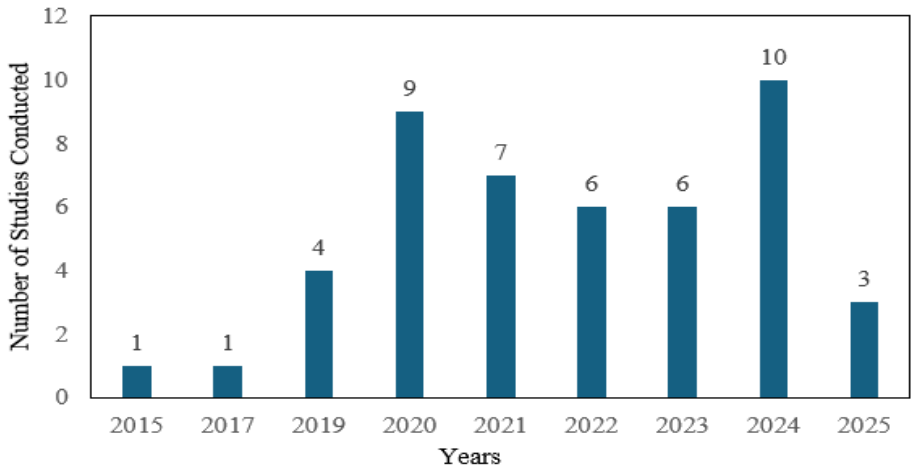


Figure 1. *Distribution of Studies by Year*

An examination of the distribution of studies by publication year shows that research on Arduino-supported robotic coding applications in the teaching of Science courses increased notably in 2020 (n = 9) and 2024 (n = 10). The year 2024 stands out as the period with the highest number of studies (n = 10) focusing on Arduino-supported robotic coding in science education.

Distribution of Robotic Sets Used in Coding Applications

The distribution of the robotic sets used in the reviewed studies is presented in Figure 2.

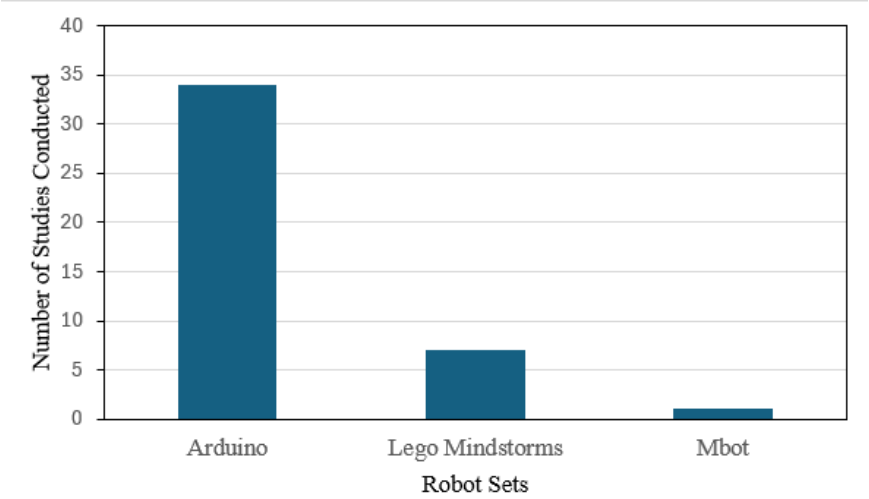


Figure 2. *Distribution of Studies by Robotic Set*

The findings indicate that, in Arduino-supported robotic coding applications within Science course instruction, the most frequently used robotic set was Arduino (n = 34), followed by Lego Mindstorms

(n = 7) and mBot (n = 2). The results show that Arduino-based studies (n = 34) were considerably more common than those utilizing other robotic sets.

Distribution of Sample Levels in the Studies

The distribution of sample levels across the reviewed studies is presented in Figure 3.

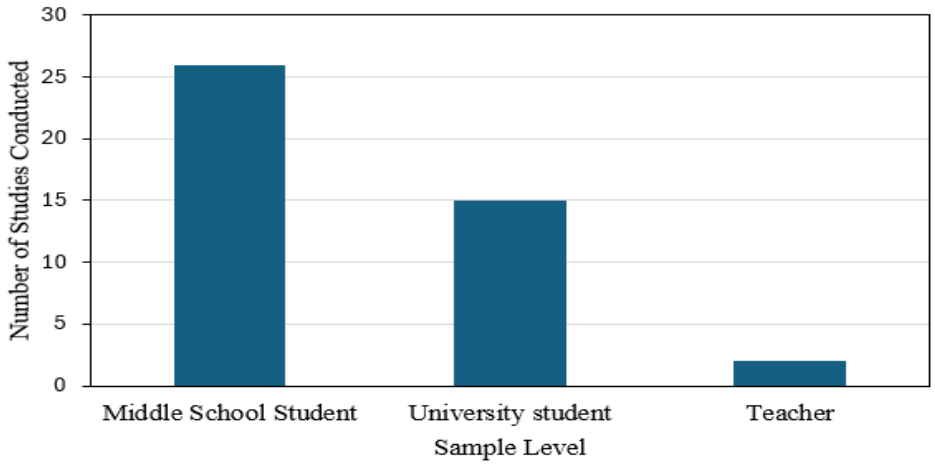


Figure 3. *Distribution of Sample Levels*

An analysis of the sample levels in the studies on Arduino-supported robotic coding applications in Science course instruction indicates that the majority of samples were drawn from middle school students (n = 26). This is an expected outcome given that the research focuses on science education and is closely associated with the "science teaching" keyword. In addition, preservice science teachers (n = 15) and in-service science teachers (n = 2) were also represented as sample groups in the reviewed studies.

Sample Sizes Used in the Studies

The overall sample sizes of all participants included in the studies are presented in Figure 4.

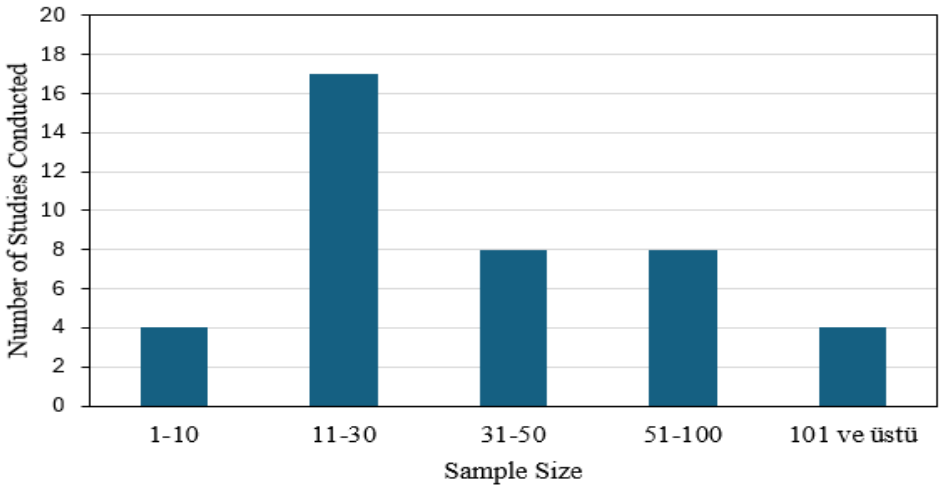


Figure 4. *Distribution of Sample Sizes*

The analysis of sample sizes across the studies shows that the most frequently used sample range was 11–30 participants (n = 17). This was followed by sample sizes of 31–50 participants (n = 8), 51–100 participants (n = 8), 101 and above (n = 4), and 1–10 participants (n = 4). The prevalence of studies with

sample sizes between 11 and 30 appears to be associated with the nature of research on Arduino-supported robotic coding applications in Science course instruction.

Research Methods Used in the Studies

The results related to all research methods employed in the reviewed studies are presented in Figure 5.

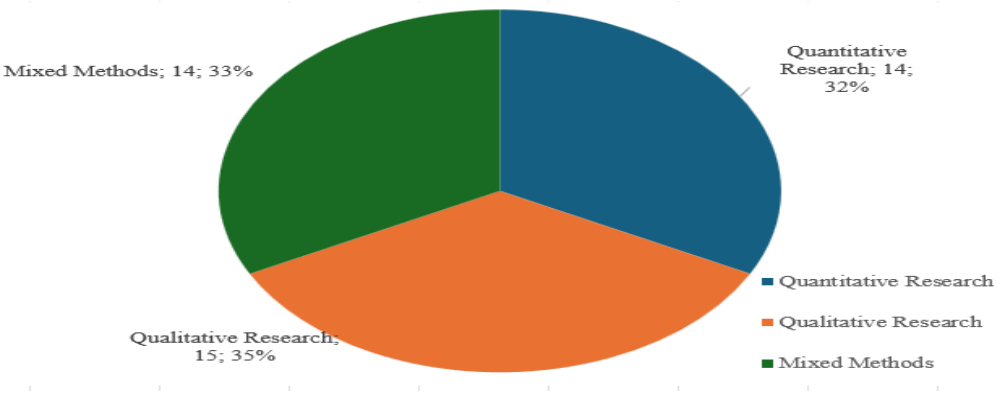


Figure 5. *Distribution of Research Methods Used*

Among the reviewed studies, 15 employed qualitative research methods, 14 used mixed-methods designs, and 14 utilized quantitative research methods.

Data Collection Techniques Used in the Studies

All data collection techniques employed in the studies are presented in Figure 6.

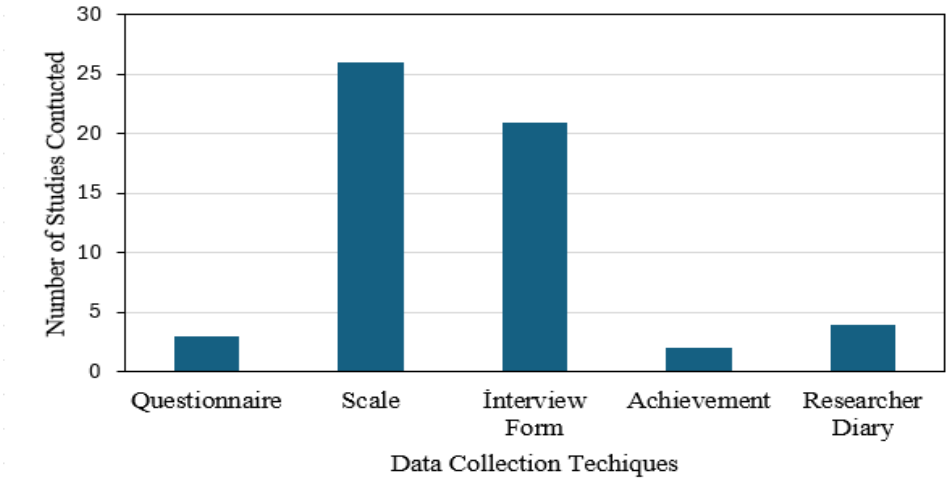


Figure 6. *Distribution of Data Collection Techniques*

An examination of the data collection techniques used in studies on Arduino-supported robotic coding applications in Science course instruction shows that, among quantitative techniques, questionnaires (n = 3), scales (n = 25), and achievement tests (n = 2) were employed. Among qualitative techniques, interview forms (n = 21) and researcher journals (n = 4) were used.

The findings indicate that scales (n = 25) were the most frequently used quantitative data collection technique, while interview forms (n = 21) were the most commonly used qualitative data collection technique in studies focusing on Arduino-supported robotic coding applications in Science education.

Dependent Variables Used in the Studies

All dependent variables examined in the reviewed studies are presented in Figure 7.

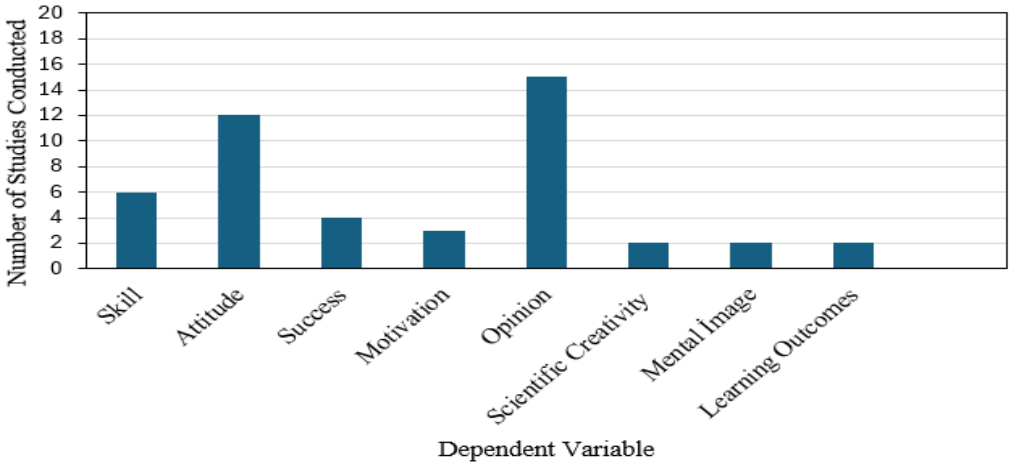


Figure 7. *Dependent Variables Used in the Studies*

An examination of the dependent variables used in studies focusing on Arduino-supported robotic coding applications in Science course instruction revealed that the most frequently investigated variables were opinions (n = 15), followed by attitudes (n = 12), skills (n = 6), achievement (n = 4), motivation (n = 3), scientific creativity (n = 2), mental imagery (n = 2), and learning outcomes (n = 2). Among these, opinions (n = 15) appeared as the most commonly studied dependent variable. In addition, attitudes (n = 12), skills (n = 6), and achievement (n = 4) were also prominent dependent variables in the reviewed literature.

Discussion, Conclusion, and Suggestions

This systematic review analyzed studies published between 2015 and 2025 according to predetermined criteria. A total of 47 studies indexed in six different databases (WoS, Google Scholar, ERIC, TRDizin, YÖKTEZ, and ProQuest) were included. Specifically, the review identified 19 studies from WoS, 15 from Google Scholar, 3 from ERIC, 4 from TRDizin, 4 from YÖKTEZ, and 2 from ProQuest.

To determine how robotics and coding applications appear in national and international research on Science course instruction, all 47 studies were examined in detail. Among these, two were master's theses and two were doctoral dissertations. Similar to existing literature, the majority of research in the field of robotics and coding has been disseminated through journal articles, while thesis-level studies remain limited. Previous studies also highlight the scarcity of thesis research on Arduino supported robotics applications in science education and emphasize the need for more graduate-level work in this field (Turhal & Bektas, 2024).

An analysis of the publication years revealed an increase in Arduino supported robotic coding studies in 2024. The growing emphasis on digitalization in recent years and the rising importance attributed to Arduino-based robotic coding practices are likely contributing factors to this increase. Technological advancements and the development of Industry 4.0 have played a significant role in the expansion of robotics applications in science teaching (Yayla Eskici et al., 2020). The literature also supports the notion that the importance of technology use in science teaching continues to rise, with robotics and coding applications becoming more widespread (Uçar et al., 2024).

Among the studies included in the review, Arduino was found to be preferred more frequently than other robotic sets. This preference is attributed to the ease of implementation provided by Arduino's drag-and-drop, block-based coding interface. The literature explains this ease of use by noting that Arduino is a microcontroller that is simple to operate and easy to understand (Atila et al., 2023). Another important factor contributing to Arduino's higher preference compared to other robotics kits is its relative affordability (Koparan Taylan et al., 2021).

An examination of the studies focusing on samples related to Science course instruction shows that the majority were conducted with middle school students (Çakır et al., 2022). This concentration at the middle school level is consistent with the study's emphasis on science teaching, as reflected in the associated keywords.

The analysis of sample sizes in the reviewed studies indicates a concentration within the 11–30 participant range. The relatively small sample sizes can be explained by the nature of robotics coding applications in science education, which often require focused implementation with limited groups. Spolaôr and Benitti (2017) similarly stated that robotics coding studies conducted in educational settings typically employ small samples, often with fewer than 100 participants.

In the reviewed studies, qualitative research methods were used more frequently than quantitative or mixed-methods approaches, although the number of studies employing quantitative and mixed-methods designs was relatively similar. Qualitative research designs typically involve conducting in-depth and intensive investigations with small participant groups (Meral, Altun, Çakır, & Samur, 2022). The prevalence of sample sizes ranging from 11 to 30 participants in the examined studies appears to be associated with the preference for qualitative research methods as the dominant research design.

In the studies examined within the scope of robotics and coding instruction in Science courses, quantitative data were collected using questionnaires, scales, and achievement tests. For qualitative data collection, interview forms and researcher journals were employed. The findings show that scales were the most frequently used quantitative data collection technique, while interview forms were the most commonly used qualitative technique. Merriam (2009) notes that interview forms are the most widely used data collection tool in studies conducted using qualitative research methods, which supports the results obtained in this review. The use of a variety of data collection techniques enables the acquisition of rich and detailed data regarding Arduino-based robotics and coding applications. In the literature, similar patterns are observed in which questionnaires and tests are commonly used as quantitative tools, while observation and interview techniques are frequently employed in qualitative research (Zhong et al., 2020).

The dependent variables identified in the reviewed studies included skills, attitudes, achievement, motivation, opinions, scientific creativity, learning outcomes, and mental imagery. In the broader literature, the dependent variables examined in robotics and coding research are categorized into cognitive and affective domains. Cognitive variables include critical thinking, creativity, problem solving, learning transfer, achievement, and inquiry learning skills, whereas affective variables consist of motivation, interest, and attitude (Talan, 2020).

Drawing on the findings obtained from the reviewed studies, the following conclusions can be made: The distribution of studies by database revealed that the majority of the included works were journal articles. The distribution by year showed that 2024 had the highest number of publications. Regarding the distribution of robotic sets used, Arduino emerged as the most frequently preferred platform.In terms of sample levels, the findings indicated that research predominantly focused on middle school students. The analysis of sample sizes revealed that the majority of studies involved 11–30 participants. With respect to research methods, qualitative designs were preferred more often than quantitative or mixed-methods approaches. The examination of data collection techniques showed that scales were the most frequently used quantitative tool, whereas interview forms were the most commonly employed qualitative tool. Finally, the analysis of dependent variables indicated that attitudes and opinions were the most frequently studied variables. Overall, it can be suggested that the increasing importance of technological advancements and the development of Industry 4.0 in recent years have contributed to the growing implementation of robotic coding applications in the teaching of Science courses.

Based on the findings of this study, the following recommendations are offered:

- Content analysis studies may be conducted on robotics and coding applications in subjects other than Science courses.
- Future research may examine additional dependent variables such as computational thinking and computational problem-solving skills beyond those identified in the current review.

- No studies employing an action research design within qualitative methodologies were identified; therefore, future research could incorporate action research to further explore robotics and coding practices.
- A clear and accessible guidebook may be developed for teachers and students, using simple and comprehensible language, to support the implementation of robotics and coding activities.

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The Usage of Sampling Weights and Plausible Values in Multilevel Models: A Tutorial with TIMSS 2023 Türkiye Data

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Abstract

International large-scale assessments are designed not merely to rank countries but to evaluate the effectiveness of educational policies and guide future improvements. Due to the high cost of nationwide data collection, such assessments use complex sampling designs, including multi-stage and stratified methods. For instance, TIMSS employs sampling at the school–class–student levels, while PISA uses the school–student structure. Accordingly, level-specific sampling weights are applied to address the non-random selection of participants. Proper incorporation of these weights is essential, as neglecting them can lead to biased parameter estimates and limit generalizability. In addition, to reduce testing burden, students respond to only a subset of test items. Therefore, achievement is estimated using plausible values—random draws from the posterior distribution of the latent trait. The literature recommends using all plausible values via multiple imputation, as relying on a single plausible value or its mean may introduce systematic bias. This study examines the impact of improper use of level weights and plausible values on the intraclass correlation coefficient (ICC) in hierarchical linear models. Data were obtained from fourth-grade students and their teachers in Türkiye who participated in TIMSS 2023 Mathematics. The dependent variable was mathematics achievement, with several student- and school-level predictors included. An illustrative model was also tested using the WeMix package. Results showed that ignoring student-level weights slightly decreased ICC (from 0.127 to 0.125), whereas omitting school-level weights substantially increased it (to 0.185). Ignoring weights at both levels resulted in an ICC of 0.159. Further, using only the average plausible value increased ICC to 0.139, while estimates calculated from individual plausible values ranged from 0.116 to 0.136. Incorrect specifications inflated ICC values by up to 46%, suggesting that policy conclusions derived from unweighted models may misrepresent school-level effects. These findings highlight the importance of correctly specifying weights and treating plausible values to avoid biased model outcomes.

Keywords: sampling weights, plausible values, multilevel models,TIMMS

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Introduction

Since the beginning of the 21st century, international educational achievement research has become increasingly widespread. The International Association for the Evaluation of Educational Achievement (IEA) and the Organisation for Economic Co-operation and Development (OECD) are the leading organisations administering large-scale assessments. IEA is known primarily for the Progress in Reading Literacy Study (PIRLS) and the Trends in International Mathematics and Science Study (TIMSS), while OECD stands out with the Programme for International Student Assessment (PISA). A search conducted in the Web of Science database using the keywords TIMSS OR PISA OR PIRLS and filtered by the research areas "education", "psychology", and "behavioral sciences" yielded a total of 6142 articles. Figure 1 visualises the number of articles published by year.

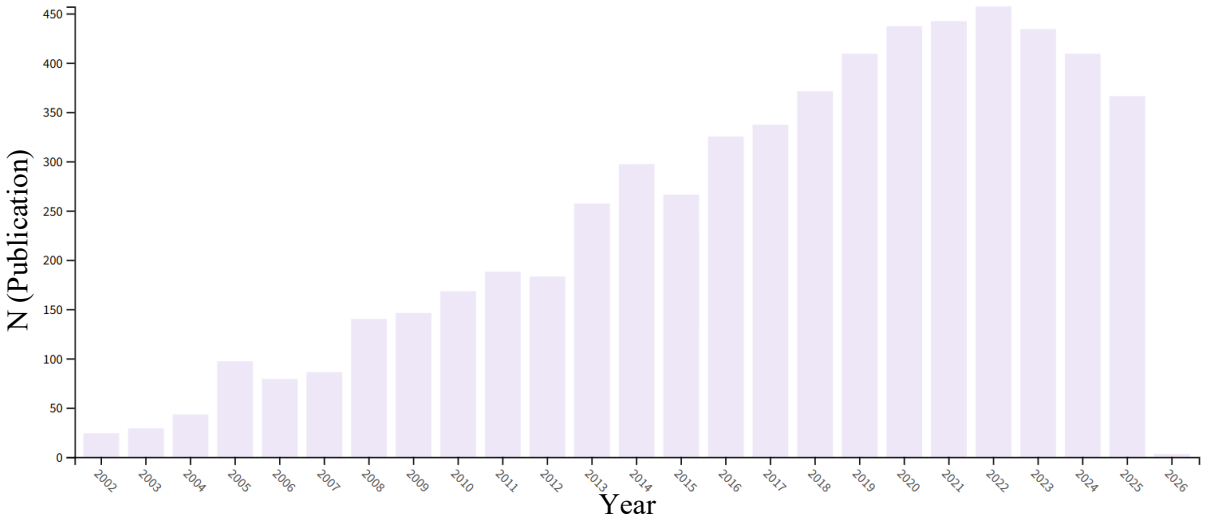


Figure 1. *Published articles across years*

The results clearly indicate that interest in these large-scale assessments has increased over the years. Before 2002, the number of studies published annually ranged from a minimum of 1 to a maximum of 24. In contrast, more than 450 studies focusing on large-scale assessments were published in 2022 alone.

In parallel with the rise in the number of publications, the implementation design and technical specifications of these large-scale tests have become a prominent area of interest among researchers. Various analytical approaches are recommended for each type of assessment. Accordingly, this study focuses on illustrating potential issues that researchers may encounter when these recommended analytical procedures are not appropriately implemented. ICC is not merely a descriptive statistic; it determines the proportion of variance attributable to school factors and guides national accountability policies, teacher resource allocation, and equity monitoring.

Design of Large-Scale Cognitive Assessments and Implications for Data Analysis

Sampling Weights: Participants included in many large-scale assessments are typically not randomly sampled, and each student does not respond to all cognitive items. Due to this design, sampling weights are applied to account for the probability of selection, which reflects each participant's representativeness within the target population. PIRLS, PISA, and TIMSS employ a two-stage stratified sampling procedure (Mullis et al., 2009, 2023; OECD, 2024; von Davier et al., 2024). In these assessments, schools are sampled in the first stage, followed by the sampling of classes and/or students. Depending on the scope and purpose of the study, criteria for inclusion are determined in advance. For example, TIMSS focuses on students enrolled in the 4th and 8th grades; therefore, the two-stage stratified sampling procedure is conducted based on students meeting this criterion.

When sampling weights are incorporated into the analyses, the results preserve the representativeness of population-level estimates for each participating country. Otherwise, it would implicitly be assumed that each sampled subgroup has an equal likelihood of occurring in the population, which is unrealistic. To illustrate this point, we revisit and adapt an example proposed by Rutkowski et al. (2010). Consider a classroom of 30 students whose reading motivation we aim to investigate. Suppose that 20 students are girls and 10 are boys. To maintain representativeness in a random sample of 15 students, the selected group should ideally consist of 10 girls and 5 boys. However, if selection occurs entirely at random without accounting for population proportions, all 15 sampled students could be girls, resulting in no representation of boys in the estimation of average reading motivation. Alternatively, 10 boys and 5 girls may be selected, underrepresenting girls' reading motivation. Therefore, when the probabilities of subgroups being present in the population are known, appropriately applying sampling weights becomes crucial.

A guiding example is provided by Olson et al. (2007), who demonstrated, using the Bulgarian sample, that differences between weighted and unweighted achievement estimates clearly highlight the necessity of preserving population representativeness.

Plausible Values: The complex booklet design and cognitive item administration framework of large-scale assessments are structured as multi-stage computerised adaptive testing (MS-CAT) to minimise test fatigue among students. Detailed information on the assessment framework and methodology of TIMSS 2023 can be accessed in von Davier et al. (2024). Although the rotated booklet administration scheme offers an advantage for students in terms of test completion, the fact that different students respond to different item clusters across booklets necessitates test linking and equating procedures. Following these linking and calibration processes, students' abilities are estimated based on the posterior probability distribution under the Item Response Theory (IRT) framework (Wu, 2005). Within TIMSS, five plausible values (PVs) are assigned to each student for each cognitive domain measured, representing the range of students' probable proficiency estimates.

In their study, von Davier et al. (2009) compared the maximum a posteriori (MAP), expected a posteriori (EAP), and weighted maximum likelihood estimation (WMLE) approaches and highlighted MAP as a more efficient estimator of ability. They also reported that using the mean of PVs may lead to biased results. Accordingly, when PVs from large-scale assessments are used through averaging or other ad hoc approaches, the validity of inferences is jeopardised.

Two common shortcuts are frequently employed in analyses using PVs. The first—also incorrect—is to select any single PV and conduct the analysis solely based on that value. Rutkowski et al. (2010) illustrated the consequences of this erroneous approach, demonstrating that standard errors estimated in linear regression models varied considerably across PV1–PV5, with significance levels also changing. Similarly, Arıkan et al. (2020) performed t-tests using different PVs and reported that statistical results varied across PVs. Although a certain level of error tolerance may be acceptable when significant effects are observed, both studies reported that for some PVs, $p > 0.05$, while for others, $p < 0.05$, which would fundamentally alter the interpretation and raise serious concerns about the validity of results.

The second shortcut relies on calculating the average of the five PVs (MEANPV) and using this value for analysis. While this approach yields similar β estimates to those obtained via ideal multiple-imputation-based pooling (Rubin, 1987), the standard errors are underestimated compared to the single-PV method. Consequently, p-values differ across PVs, and reduced standard errors may lead to misleading interpretations due to inflated Type I error rates. In contrast, Rubin's approach combines both within- and between-measurement variances and provides more accurate parameter estimates. This method is the recommended procedure for large-scale assessments (von Davier et al., 2009; von Davier et al., 2024).

The potential errors in handling both sampling weights and PVs clearly indicate that improper application may lead to biased statistical inferences. Existing studies have predominantly focused on the effects of incorrect PV usage on hypothesis testing outcomes, differences in effect sizes, and explained variance, as well as on the implications of sampling weight specification on variance estimation and overall model fit (Arıkan et al., 2020; Rutkowski et al., 2010). Although Huang (2024) demonstrated the optimal implementation of these procedures using the free statistical software R (R Core Team,

2024), they did not examine the consequences of incorrectly specified arguments. Therefore, the present study aims to (i) identify the potential consequences of improper analytical specifications using HLM with TIMSS 2023 data from Türkiye and (ii) demonstrate appropriate argument use via the WeMix package (Bailey et al., 2018).

Accordingly, this study addresses the following research questions:

- How do intra-class correlation (ICC) estimates vary across different approaches to plausible value (PV) usage?
- How do ICC estimates change across weighting scenarios based on alternative specifications of sampling weights?

Method

Sample

The sample of this study consisted of 4541 students from 141 different schools who participated in the TIMSS 2023 assessment. TIMSS 2023 is administered to students in the 4th and 8th grades; however, Türkiye participated in TIMSS 2019 and TIMSS 2023 with students from the 5th and 8th grades. The dataset used in this study includes students' mathematics test scores from TIMSS 2023, affective domain questionnaire responses, and various indices derived from items responded to by school principals regarding the schools in which the students are enrolled.

Measures

For students who participated in the TIMSS 2023 Mathematics Test, five plausible values (ASMMAT01–ASMMAT05) were provided to represent their mathematics achievement. To predict students' mathematics performance, the study incorporated variables at both the student level (Level 1) and the school level (Level 2) within a HLM framework. Table 1 summarises the variables included in the HLM analyses and presents relevant descriptive information.

Table 1.
Variables Included in the HLMs

Variable Type	Variable Name	Desription	Level	Scale
Dependent	ASMMAT01:ASMMAT05	Mathematics achievement	1	$\bar{X}$ = 500, SD = 100
Independent	ITSEX	Gender	1	1: Girl, 2: Boy (Boys were the reference category)
Independent	ASBGDML	Disorderly Behavior during Math Lessons	1	Continuous
Independent	ASBGICM	Instructional Clarity in Mathematics Lessons	1	Continuous
Independent	ASBGSLM	Students Like Learning Mathematics	1	Continuous
Independent	ASBGHRL	Home Resources for Learning	1	Continuous
Independent	ACBGMRS	Instruction Affected by Math Resource Shortage	2	Continuous
Independent	ACBGEAS	School Emphasis on Academic Success-Principal	2	Continuous
Independent	ACBGLNS	Students Begin with Literacy and Numeracy Skills	2	Continuous

These predictors were selected because prior TIMSS-based studies have shown that instructional clarity, school emphasis on academic success, and home resources are among the strongest determinants of mathematics achievement.

Data Analysis

This section presents the two-level model specified for the HLM analyses, outlines the use of plausible values, and describes the recommended procedural steps for incorporating sampling weights within the *WeMix* package (Bailey et al., 2018).

The two-level hierarchical linear model (student and school levels) was specified as follows:

Level 1:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{ITSEX}_{ij}) + \beta_{2j}(\text{ASBGDML}_{ij}) + \beta_{3j}(\text{ASBGICM}_{ij}) + \beta_{4j}(\text{ASBGSLM}_{ij}) + \beta_{5j}(\text{ASBGHRL}_{ij}) + r_{ij}$$

Level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{ACBGMRS}_j) + \gamma_{02}(\text{ACBGEAS}_j) + \gamma_{03}(\text{ACBGLNS}_j) + u_{0j}$$

$$\beta_{1j=}\gamma_{10}$$

$$\beta_{\dots j=}\gamma_{\dots 0}$$

$$\beta_{5j=}\gamma_{50}$$

To address the first research question, alternative approaches to using plausible values (PVs) were considered. Accordingly, hierarchical linear models were estimated separately using both the mean of the PVs (MEANPV) and each individual PV (PV1–PV5), employing the mix function from the *WeMix* package (Bailey et al., 2018). Although the mix function includes multiple arguments, only the *formula*, *data*, and *weights* arguments were specified in this study. To pool the HLM estimates obtained from the five PV models, Rubin's (1987) rule was applied using the *mixPV* function developed by Huang (2024). Both functions report robust standard errors to account for potential heterogeneity of variance violations (Liang & Zeger, 1986). The statistical significance of the β coefficients for the predictor variables was evaluated using the Wald test. Table 2 summarises the seven models specified to address the first research question.

Table 2.
Syntaxes for RQ1

Model	Syntax
MEANPV	mix(formula=MEANPV~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+ (1 | IDSCHOOL), data = data,weights = c("STUWEIGHT", "SCHWEIGHT"))
PV1	mix(formula=ASMMAT01~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+ (1 | IDSCHOOL), data = data,weights = c("STUWEIGHT", "SCHWEIGHT"))
PV2	mix(formula=ASMMAT02~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+ (1 | IDSCHOOL), data = data,weights = c("STUWEIGHT", "SCHWEIGHT"))
PV3	mix(formula=ASMMAT03~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+ (1 | IDSCHOOL), data = data,weights = c("STUWEIGHT", "SCHWEIGHT"))
PV4	mix(formula=ASMMAT04~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+ (1 | IDSCHOOL), data = data,weights = c("STUWEIGHT", "SCHWEIGHT"))
PV5	mix(formula=ASMMAT05~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+ (1 | IDSCHOOL), data = data,weights = c("STUWEIGHT", "SCHWEIGHT"))
Pooled PV	mixPV(ASMMAT01+ASMMAT02+ASMMAT03+ASMMAT04+ASMMAT05~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+ (1 | IDSCHOOL), data = data, weights = c("STUWEIGHT", "SCHWEIGHT"))

To address the second research question, four different weighting scenarios were examined within the hierarchical linear modeling framework. These scenarios were defined as follows: (i) modelling sampling weights at both the student and school levels, (ii) ignoring the school-level sampling weights, (iii) ignoring student-level sampling weights (assuming equal weighting across students, STUNOWEIGHT = 1), and (iv) ignoring both student- and school-level sampling weights (assuming

SCHNOWEIGHT = 1). This approach enabled the assessment of the extent to which sampling weights influence model estimates at each level.

Sampling weights were calculated in accordance with the procedures recommended by Rutkowski et al. (2010) and implemented following the guidelines proposed by Arıkan et al. (2020) The final weights were added to the dataset as a new variable and included in the estimation process when applicable. Table 2 presents the syntax used to specify the four weighting scenarios tested for Research Question 2 (RQ2).

Table 3.
Syntaxes for RQ2

Model	Syntax
Both levels weighted	mixPV(ASMMAT01+ASMMAT02+ASMMAT03+ASMMAT04+ASMMAT05~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+(1 | IDSCHOOL), data = data, weights = c("STUWEIGHT", "SCHWEIGHT"))
L1 weights are ignored	mixPV(ASMMAT01+ASMMAT02+ASMMAT03+ASMMAT04+ASMMAT05~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+(1 | IDSCHOOL), data = data, weights = c("STUNOWEIGHT", "SCHWEIGHT"))
L2 weights are ignored	mixPV(ASMMAT01+ASMMAT02+ASMMAT03+ASMMAT04+ASMMAT05~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+(1 | IDSCHOOL), data = data, weights = c("STUWEIGHT", "SCHNOWEIGHT"))
Both sampling weights are ignored	mixPV(ASMMAT01+ASMMAT02+ASMMAT03+ASMMAT04+ASMMAT05~ITSEX+ACBGMRS+ACBGEAS+ACBGLNS+ASBGDML+ASBGICM+ASBGSLM+ASBGHRL+(1 | IDSCHOOL), data = data, weights = c("STUNOWEIGHT", "SCHNOWEIGHT"))

The ICC values corresponding to the specified models were calculated based on Equation 1.

$$\text{ICC} = \frac{\tau_{00}}{\tau_{00}+\sigma^2} \quad (1)$$

Where τ_{00} represents the variance between Level-2 units (schools fort his study), σ^2 refers tot the residual variance at Level-1 (students within students).
Where τ_{00}represents the variance between Level-2 units (schools in this study) and σ^2refers to the residual variance at Level 1 (students within schools). Since ICC values are not automatically pooled when using the mixPV function in the *WeMix* package, the average of the ICC values obtained from the analyses was reported. All analyses were conducted using R version 4.5.2 (R Core Team, 2024). Hierarchical linear modeling was performed using the *WeMix* package (Bailey et al., 2018), including additional functions developed by Huang (2024) for handling PVs. For data screening, *dplyr* (Wickham et al., 2023) and *tidyr* (Wickham et al., 2024) packages were used, while visualisations were generated using *ggplot2* (Wickham, 2016).

Findings

The findings are presented in two stages. First, outputs related to potential inconsistencies arising from alternative usages of PVs (RQ1) are reported. Subsequently, results from the four weighting scenarios implemented in the HLMs (RQ2) are presented.

Research Question 1

As previously noted, seven alternative scenarios were considered in relation to the use of plausible values. These scenarios included the use of the mean plausible value (MEANPV), the separate estimation of models using each of the five plausible values, and the pooled PV results. The ICC values obtained under each scenario are presented in Figure 2.

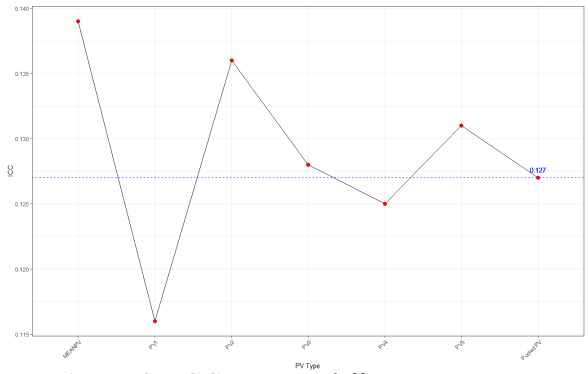


Figure 2. *ICCs across different PV usage*

Note: MEANPV = 0.139, PV1 = 0.116, PV2 = 0.136, PV3 = 0.128, PV4 = 0.125, PV5 = 0.131, Pooled PV = 0.127

The ICC obtained from the pooled plausible values approach which represents the ideal method was 0.127 and was included in the graph as a dashed reference line. Accordingly, the ICC values for each individual PV differed from this benchmark. The highest ICC value was obtained using MEANPV (ICC = 0.139), while the lowest value was observed for PV4 (ICC = 0.116). The variability observed in ICC estimates across models with random intercepts suggests that different approaches to PV handling may result in different interpretations of the model outcomes. To provide a more detailed examination, Figure 3 presents the regression coefficients (β) and their significance levels for each PV-based model.

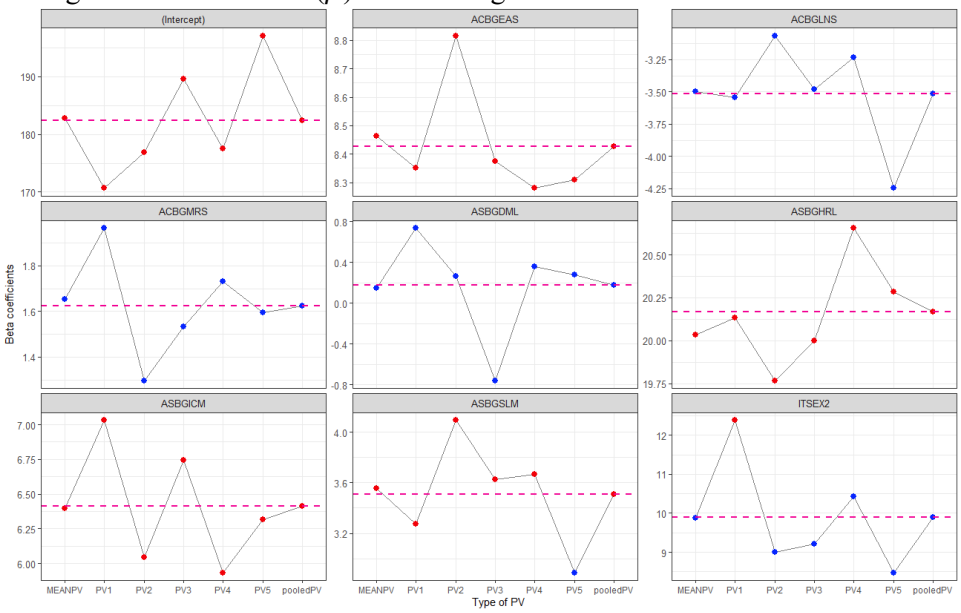


Figure 3. *Comparing β coefficients of Student and School Level Variables*

Note. Variables statistically significant according to the Wald test (red) and non-significant (blue).

Upon Figure 3, pooled PV representing the recommended approach indicate that ACBGEAS, ASBGHRL, ASBGICM, and ASBGSLM are statistically significant predictors. However, under the scenario in which PV5 is used, ASBGSLM is no longer statistically significant. A similar issue arises with the gender variable (ITSEX): although gender differences are not statistically significant when using the pooled PV, the use of PV1 leads to a misleading conclusion that gender has a significant effect. These results suggest that improper handling of plausible values may lead researchers to incorrect statistical inferences.

Furthermore, while the same variables emerge as significant across most scenarios, the estimated regression coefficients (β) vary depending on the PV used. No systematic pattern was observed in these variations; in some cases, coefficients were lower than those obtained from the pooled PV results, whereas in others, they were higher. This inconsistency highlights the importance of adopting the appropriate PV handling method to avoid biased or unstable model estimates.

Research Question 2

This section presents the results obtained from testing the four weighting scenarios. ICCs were computed separately for each scenario, and differences in the specification of sampling weights were visualised in Figure 4.

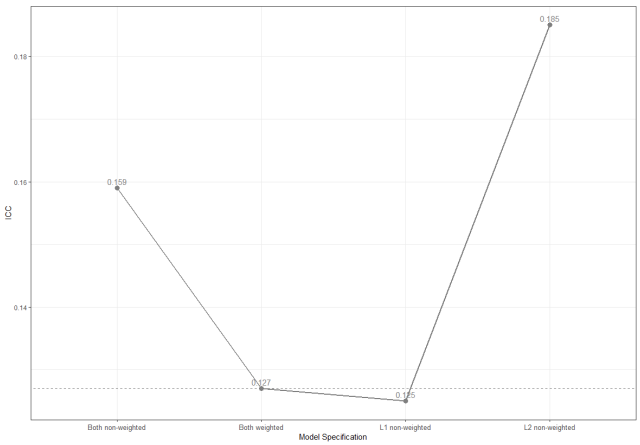


Figure 4. *ICCs across model weighting specifications*
Note. The pooled plausible values (PV) approach was used in the full-sample specification scenario.

To examine the impact of sampling weight specification, Figure 4 presents ICC estimates for all four scenarios. The model applying weights at both levels resulted in an ICC of 0.127, which is considered the ideal benchmark. When student-level weights were ignored, the estimated ICC slightly decreased to 0.125, representing a negligible difference of 0.002 from the optimal specification. In contrast, omitting school-level weights (ICC = 0.185) or disregarding weights at both levels (ICC = 0.159) led to substantially higher ICC values relative to the reference scenario. These findings indicate that failure to correctly apply school-level sampling weights may lead researchers to overestimate the proportion of variance attributable to between-school differences. An increase from .127 to .185 corresponds to approximately 46% inflation in between-school variance, which could mislead policymakers into believing that school-level factors dominate individual characteristics.Conversely, neglecting student-level weights appears to have minimal impact on ICC estimation.
Although this study focuses specifically on ICC values, it is important to note that improper weight specification may also introduce bias in the estimation of regression coefficients (β), potentially leading to inaccurate conclusions regarding the proportion of variance explained at both levels of the model.

Discussion, Conclusion, and Suggestions

Our findings provide answers to the two main research questions. The first relates to the use of different plausible value (PV) specifications, and the second concerns the definition of sampling weights. Regarding RQ1, we found that using any single PV may result in some predictors appearing statistically significant while others appear non-significant. Furthermore, ICC estimates varied considerably, ranging from 0.116 to 0.139, representing a deviation of approximately –8% to +9% from the ideal ICC value (0.127) obtained using the recommended approach. In scenarios where sampling weights were specified differently, ICC estimates ranged from 0.125 (–1%) to 0.185 (+22%). These results clearly support the same recommendation emphasised in previous studies: the rules proposed by Rubin (1987) should be followed when working with PVs, and sampling weights must be appropriately defined (Arıkan et al., 2020; Rutkowski et al., 2010; von Davier et al., 2009; Wu, 2005).
Following the “PISA shock” (Dixon et al., 2013), countries such as Germany and Japan made substantial revisions to their education policies based on the findings. Additionally, Mexico requested the restriction of public access to the results of TIMSS 1995. These examples provide compelling evidence that large-scale assessments have a decisive influence on national education policy development. As previously noted, interest in these assessments continues to increase over time; however, when certain methodological specifications are not applied correctly, the conclusions drawn from such studies may mislead researchers.

Consistent with the findings of Rutkowski et al. (2010), we also observed in the present study that the significance levels of predictors may vary depending on the PV employed. Even if a PV were selected for which p-values did not differ from those obtained using the pooled PV approach, both β coefficients and ICC estimates would still exhibit variability. Therefore, we consider that this study comprehensively addresses the validity threats that may arise due to improper model specification. These results confirm Rutkowski et al.'s (2010) claim that ignoring sampling design parameters yields overestimated school effects, yet our findings extend the literature by demonstrating that such distortions occur even when predictors and model structure remain unchanged.

Based on the findings of the present study, the following recommendations are proposed for researchers:

1. PV pooling rules

- Avoid using single PVs or mean PV unless solely for descriptive purposes.
- Use Rubin's (1987) rule to properly combine estimates and standard errors across all PVs.
- When using R, implement *mixPV* or equivalent pooling functions instead of manual averaging or analyzing only a single PV.

2. Apply sampling weights

- Ensure that sampling weights are assigned at both the student and school levels.
- When weights are missing (e.g., SCHNOWEIGHT or STUNOWEIGHT), researchers should report this explicitly and provide a rationale for weight omission due to sampling design of their study.

The findings of this study are limited to the responses provided by students who participated in the TIMSS 2023 Grade 4 Mathematics Test and by the school principals. Although the study can be replicated using different datasets, our findings primarily address methodological issues; therefore, no specific criteria were applied for the selection of predictor variables.
In addition, workshops may be organised to encourage researchers to correctly apply pooled PV outputs and sampling weights. It is further recommended to promote tutorials on pooling functions available in packages such as EdSurvey (Bailey et al., 2017), WeMix (Bailey et al., 2018), and mice (van Buuren & Groothuis-Oudshoorn, 2011), in order to support researchers in implementing appropriate analytical procedures.

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Unpacking Item Format Effects in TIMSS2023 Mathematics Assessment: Evidence from Balkan Countries Using Explanatory Item Response Modeling

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Abstract

Items are used to assess students' knowledge and skills. Item formats can generally be categorized into multiple-choice and constructed-response types. Different item formats require different response behaviors. In multiple-choice items, there is typically one correct answer and several distractors, whereas constructed-response items do not include options. Each format has its own advantages and disadvantages. For instance, setting options for multiple-choice items can be costly, while scoring constructed-response items can be labor-intensive. Although multiple-choice items are easier to score, constructed-response items offer students the opportunity to provide original answers. Both formats can be used to assess higher-order thinking skills (e.g., reasoning), though there is still no consensus among researchers on this issue. Due to factors such as familiarity with item format, guessing, and elimination strategies, multiple-choice items may seem easier to respondents (in other words, they may have higher item difficulty). This is especially true for students with lower proficiency in the measured skill, who may engage in such behaviors and benefit from multiple-choice items. In this study, we examined the probability of correct responses to 12 mathematics items (six multiple-choice and six constructed response) related to the topic of number and the domains of applying and reasoning, using Explanatory Item Response Theory (EIRT) models and the Generalized Linear Mixed Models (GLMM) procedure. The data came from students in nine Balkan countries (Albania, Bosnia and Herzegovina, North Macedonia, Montenegro, Romania, Serbia, Slovenia, Kosovo, and Türkiye) who participated in TIMSS 2023. As a remark, Croatia and Greece did not participate in TIMSS 2023. Bulgarian students did not answer the items that we analyzed. Item format was defined as a item-level predictor (multiple-choice vs. constructed response). Null model, fixed effects model, and random-effects model were compared. The random-effects model provided the best fit and explained 13.1% of the variance. Results showed that multiple-choice items were significantly easier for students overall, in other word, the probability of giving correct answers to multiple-choice items is significantly higher than constructed response items ($\beta = 4.32$, S.E. = 0.85, $p < 0.001$) and they provided an advantage particularly for students with lower mathematical ability ($\rho_{01} = -0.51$). These findings show that failure to account for response format may inflate achievement estimates and distort cross-country comparisons, particularly in education systems where students are more accustomed to multiple-choice formats.

Keywords: Explanatory item response modelling, item format, mathematics, constructed-response.

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Introduction

One of the key stages in the development of cognitive skill assessments is the selection of the appropriate item format (Hohensinn & Kubinger, 2011). Item format is not only important in terms of adequately measuring the target construct but also with respect to differences in respondent behavior. Today, assessment instruments commonly include multiple-choice (MC), open-ended (OE), constructed-response (CR), fill-in-the-blank, matching, and similar item types. Although there is no universally optimal item format, several factors—such as the nature of the measured construct, time constraints, the stakes of the assessment, and its intended purpose—play a decisive role in item format selection. Broadly, item formats can be categorized into two main groups: (i) constructed-response (CR) and (ii) multiple-choice (MC) items (Hohensinn & Kubinger, 2011). While MC items consist of one correct answer and a set of distractors, CR items do not provide options and require the respondent to actively construct an answer. Thus, the cognitive and behavioral processes involved in responding differ substantially between the two formats.

Previous research has highlighted two critical issues related to item format: (i) dimensionality and (ii) performance differences. Variations in response behavior due to format may act as an unintended source of variance in the ability–item relationship and could threaten both item difficulty estimates and validity evidence (Whitely, 1983). Indeed, concerns have been raised that item format may introduce an additional dimension to the assessment beyond the intended construct (Cao, 2008). Rodriguez (2003), analyzing 56 correlation coefficients from 29 studies, reported that scores from CR and MC items sharing the same stem were highly correlated (approximately $r = 0.95$). Although this finding appears to contradict earlier research documenting substantial format-based performance discrepancies, numerous recent studies continue to report systematic differences in student performance across item formats (Hohensinn & Kubinger, 2011; Iñarrairaegui et al., 2022; In'nami & Koizumi, 2009; Ko, 2010; Marcq et al., 2024; Marcq & Braeken, 2025).

Across studies, the general trend indicates that MC items are easier than CR items (Dudycha & Carpenter, 1973; In'nami & Koizumi, 2009; Iñarrairaegui et al., 2022; Marcq et al., 2024; Marcq & Braeken, 2025; Sangwin & Jones, 2017; Woodcock et al., 2020). However, this should not simply be interpreted as CR items measuring more complex skills. Unlike CR items, MC items provide options, and when, for instance, one correct option and three distractors are presented, the probability of selecting the correct answer purely by chance is 25%. Factors such as guessing, elimination strategies, and test familiarity (Rauch & Hartig, 2010) may further increase the likelihood of arriving at the correct answer, which could result in item difficulty being underestimated. Neglecting such subtle but critical distinctions may explain why CR items have historically—and even currently—been perceived as more difficult than MC items. This raises the question of whether a "Lindy effect" exists regarding item format, where historically accepted assumptions persist without being critically re-evaluated. Therefore, modeling performance differences between CR and MC items is crucial.

Another essential question is whether the impact of item format operates similarly across all students. For instance, Shear (2023) found that male students performed better on MC items, whereas female students performed better on CR items in the mathematics and reading assessments of PISA 2015. Parallel findings were reported by Beller and Gafni (2000), who observed that females performed better on CR items. Schwabe et al. (2015) discussed the influence of age and intrinsic reading motivation on reading performance. Additionally, the language commonly spoken at home and item format have been reported as influential factors (Bulut et al., 2023). Collectively, these findings suggest that students' background characteristics influence their performance depending on the item format used.

Although the literature provides strong evidence of such differences, it remains unclear whether students with lower proficiency are disproportionately affected by item format. Considering that low-ability students may struggle to generate responses to CR items while still having a probability of correctly answering MC items through guessing or elimination, format effects may be more pronounced among low-performing students. Although previous studies have compared item formats in international

assessments, no study has examined how item format interacts with student ability across multiple Balkan countries using explanatory item response modeling.

Within this context, the current study aims to examine the effect of item format using a set of mathematics items from the TIMSS 2023 Assessment. Accordingly, we address the following research questions:

1. Does item format have a statistically significant effect on the probability of a correct response?
2. Does the effect of item format on the probability of a correct response vary across students?

Method

Sample

A total of 6095 fourth-grade students were included in the analysis based on their participation in the TIMSS 2023 Mathematics Test. Detailed sample distribution by country is provided in Table 1.

Table 1.
The Number of Participants Across Balkan Countries

Country	N	%
Albania (ALB)	346	6
Bulgaria (BGR)	1018	17
Bosnia and Herzegovina (BIH)	502	8
North Macedonia (MKD)	680	11
Montenegro (MNE)	643	11
Romania (ROM)	526	9
Serbia (SRB)	526	11
Slovenia (SVN)	646	11
Türkiye (TUR)	651	11
Kosovo (XKX)	389	6

Students responded to a total of 12 items included in Booklet 1 or Booklet 4, consisting of seven items from the Applying domain and five items from the Reasoning domain of the TIMSS 2023 Mathematics cognitive framework. The item set was equally balanced in terms of response format, comprising six multiple-choice (MC) and six constructed-response (CR) items. However, these booklets were not administered to students in Bulgaria, resulting in missing item-level data for this country. Consequently, Bulgarian students were excluded from the analytical sample, and analyses were conducted on a final dataset of 5.077 fourth-grade students. Among students who responded to all 12 items, approximately 48% were female.

Data Analysis

To assess the pattern of missing data, Little's Missing Completely at Random (MCAR) test (Little, 1988) was conducted. The results indicated a statistically significant deviation from MCAR ($\chi^2 = 2638.94$, df = 492, $p < 0.001$), suggesting that missingness was not completely random. The overall proportion of missing responses was 15.4%. In line with the OECD reporting strategy (Atar et al., 2021; OECD, 2024), omitted responses were recoded as 0. Partially credited constructed-response items were recoded as 1, resulting in a dichotomous item-response matrix, where 0 = incorrect and 1 = correct response.

The assumptions of Item Response Theory (IRT) were examined across all 12 items. To determine the number of latent dimensions, Parallel Analysis based on Minimum Rank Factor Analysis (PA-MRFA; Timmerman & Lorenzo-Seva, 2011) was performed. PA-MRFA analysis recommended a unidimensional structure. Subsequently, Exploratory Factor Analysis (EFA) was conducted using the MINRES estimation method (equivalent to unweighted least squares; Jöreskog, 2003), based on a polychoric/tetrachoric correlation matrix due to the binary nature of the data (Holgado-Tello et al., 2010). Factor loadings ranged from 0.67 to 0.85, accounting for 60% of the total variance. Several items exhibited testlet effects, as indicated by Yen's Q statistic, suggesting potential violations of local item independence. These testlets included items with both MC and CR formats. However, given that the

item format was explicitly modeled as a covariate at the item level, testlet effects were not further modeled for as a limitation. The internal consistency of the 12-item scale was acceptable, with Cronbach's α = 0.88 and McDonald's ω = 0.88.

In the context of GLMM analyses, the probability that an individual correctly responds to an item can be expressed as a simple logistic function, as shown in Equation 1. When the model is considered within the Rasch measurement framework, where the discrimination parameter is constrained to $\boldsymbol{a} = \mathbf{1}$, Equation 1 can be reformulated as Equation 2:

$$\pi_{pi} = \frac{e^{(\theta p - \beta_i)}}{1 + e^{(\theta p - \beta_i)}} \quad (1)$$

$$\eta_{pi} = \theta_p - \beta_i \quad (2)$$

where π_{pi}, is the propability of person p correctly responding to item I, θ_p is the ability level of person p where negative values reflect low ability and positive values reflect high ability which comes from normal distribution N(0,σ^2); β_i are fixed parameters and represent the difficulty level of item i. When the model is reconsidered based on the Rasch framework, Equation 1 can be reformulated as Equation 2. Here, η_{pi} represents the function corresponding to the logit of the probability of a correct response (i.e., log-odds).

When person-level covariates are included in the model, but item-level covariates are not the explanatory item response model (EIRM) is referred to as a person EIRM (latent regression model; LRM). Eq. 2 can be easily extended to the person EIRM by Eq. 3;

$$\theta_p = \sum_{j=1}^{J} \vartheta_j Z_{pj} + \theta_p^* \quad (3)$$

θ_p, is defined by $\sum_{j=1}^{J} \vartheta_J Z_{pj}$, where Z_{pj} is a value for person p on covariate j (j = 1…. J; e.g. gender); ϑ_j is the regression weight for the person-level covariate, and the θ_p^* is the remaining person effect (random-effect) is not explained by Z_{pj} and is $N(0,\sigma^2)$.

When item-level covariates are included but person-level covariates are not, the EIRM is an item explanatory model (linear logistic test model; LLTM) . Eq. 2 can be extended to this model as following by Eq. 4:

$$\eta_{pi} = \theta_p - \beta_i \quad (2)$$

$$\beta_i' = \sum_{k=1}^{K} \beta_k X_{ik} + \beta_i^* \quad (4)$$

Notice here the explicit connection between the Eq. 2 proportion of Eq. 4 and that the item epxlanatory portion of the model is substitutionary of β_i in Eq. 4, β_i' is defined by $\sum_{k=1}^{K} \beta_k X_{ik}$, where X_{ik} is a value for item i on item covariate k (k = 1…… K; e.g. item format), β_k is the regression weight for the item-level covariate, and β_i^* is the random effect.

In this study, no person-level predictors will be included in the model; instead, only item-level covariates (i.e., item format) will be incorporated. Three models will be evaluated sequentially: the null model, the fixed-effect model (LLTM), and the Random-effects model, in which the effect of item format is allowed to vary across individuals. Model comparisons will be carried out using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), log-likelihood (LL), deviance (−2LL), conditional R^2, and Likelihood Ratio Tests (LRTs), implemented via functions from the *performance* package in R (Lüdecke et al., 2021). Lower values of deviance, AIC, and BIC will indicate better model fit, whereas higher LL values will suggest improved alignment with the observed data. The conditional R^2statistic will be used to estimate the proportion of variance explained jointly by the fixed and random effects, providing a more comprehensive evaluation of model performance within mixed-effects modeling frameworks.

The model estimation procedures were based on the following formulations:

1- Null Model:
Response ~ (1 | STUDENTID) + (1 | Items)
2- Fixed-effects:
Response ~ Type + (1 | STUDENTID) + (1 | Items)
3- Random-Effects Model:
Response ~ Type + (1 + Type | STUDENTID) + (1 | Items)

To account for differential selection probabilities and ensure representativeness, model estimates were weighted using the TOTWGTS variable, following established recommendations for large-scale educational surveys (von Davier et al., 2024; Winship & Radbill, 1994).

Findings

The results are presented in four steps: (i) descriptive comparison of correct response rates by item format, (ii) cross-country comparison of format-based performance patterns, (iii) model-based evaluation using three models, and (iv) cross-country comparison of the best model.

Figure 1 shows that MC items yielded notably higher correct response rates, while CR items were considerably more challenging. These findings indicate that raw score interpretations may be confounded by response format, underscoring the need to model format effects to obtain valid achievement estimates.

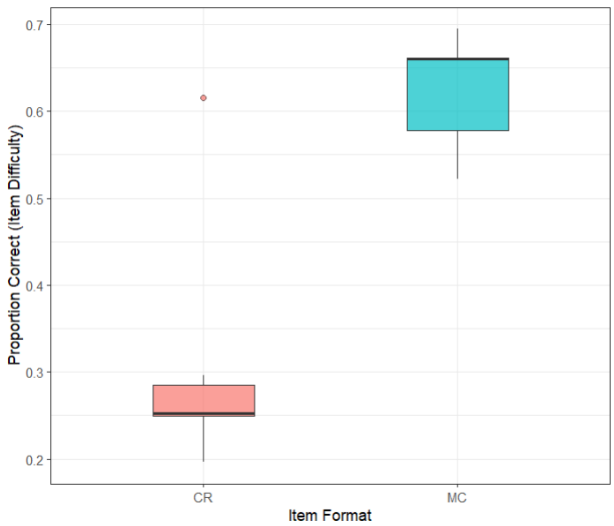


Figure 1. *Average Item Difficulty Across Item Types*

Figure 2 illustrates clear cross-national differences in item difficulty based on response format. Across all countries, MC items consistently exhibited higher mean proportion-correct values than CR items, indicating that MC items were substantially easier on average. The mean correct response rates for MC items ranged approximately from 0.50 to above 0.80, with the highest averages observed in Türkiye and Slovenia, followed by Romania and Serbia. In contrast, the mean performance on CR items was noticeably lower, typically below 0.40 across countries, confirming that students generally struggled with items requiring constructed answers. Notably, Türkiye and Slovenia also stood out with relatively higher mean performance on CR items, suggesting that learners in these systems may be more capable of generating extended responses or engaging in deeper reasoning. Overall, these results provide strong evidence of a systematic response format effect, with MC items appearing easier across educational systems.

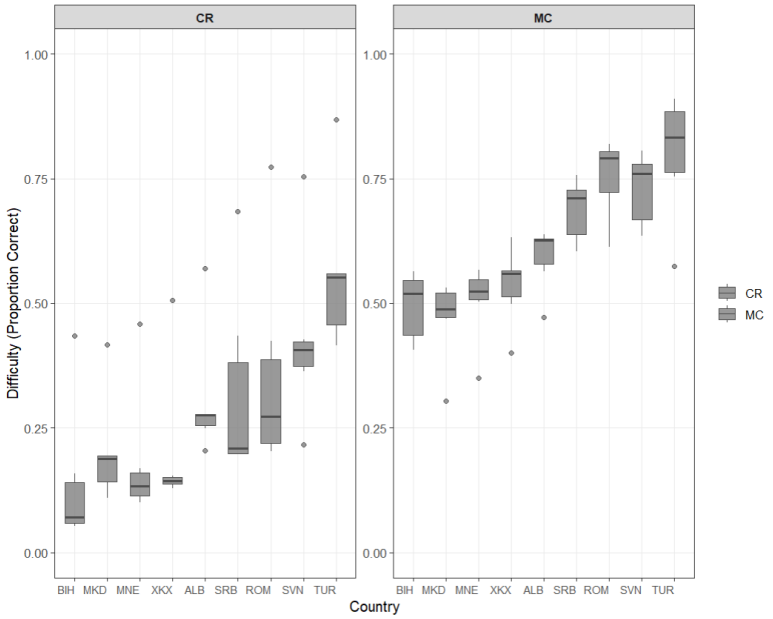


Figure 2. *Item Difficulty Across Countries For Item Type*

GLMM Model Comparison

Table 2 presents the model fit statistics and likelihood ratio test (LRT) results for the three estimated models. The random-effects model demonstrated the best overall model fit, as indicated by the lowest AIC, BIC, and −2LL values. Furthermore, the fixed-effects model differed significantly from the null model according to the LRT results, suggesting that the inclusion of item format as a fixed predictor improves model performance at a statistically significant level. These findings indicate that item format contributes meaningfully to explaining variability in item difficulty, and that allowing random variance components enhances model fit beyond fixed-effects modeling alone.

Table 2.

Comparison of the Alternative Three Models

Model	AIC	BIC	LL	-2LL	$\Delta\chi^2(\Delta df)$	*p-value*
Null	1492476	1492503	-746235	1492470		
Fixed-Effects	1492470	1492506	-746231	1492462	8.05 (1)	<0.01
Random-effects	1290813	1290867	-645401	1290801	201660.62 (2)	<0.001

The Random-effects model also differed significantly from the fixed-effects model, indicating that allowing the effect of item format to vary across individuals significantly improved the model. This suggests that the impact of response format is not constant across students but rather exhibits meaningful inter-individual variability. Therefore, modelling item format as a random-effect contributes additional explanatory power better than modelling as a fixed-effect.

As shown in Table 3, incorporating the response format substantially improved the model's explanatory power. In the fixed-effects model, the effect of MC format was significant ($\beta = 2.217$, $SE = 0.655$, $p < 0.001$), indicating that items presented in MC format were, on average, approximately $e^{(2.217)} = 9.19$ times easier than CR items. When random effects were added, the magnitude of this effect increased further ($\beta = 4.327$, $SE = 0.849$, $p < 0.001$), suggesting considerable variability in how individuals respond to format differences. MC items were approximately $e^{(4.327)} = 75.71$ times easier than CR items according to the random-effect model. The random-effects model also showed substantial variability both between students (SD = 5.423) and items (SD = 1.469), with a moderate negative correlation between intercepts and format sensitivity at the student level ($\tau = -0.512$), suggesting that students who performed better overall tended to show slightly less advantage from the MC format. Model fit indices support the importance of including the item format effect. The marginal explained variance increased from 0% in the null model to 13.1% in the random-effects model, demonstrating that item format alone accounted for 13.1% of the explainable variance in the probability of the correct response. These unusually large

odds ratios are partly attributable to the absence of a guessing parameter in the Rasch framework, suggesting that format advantages may be overestimated when pseudo-guessing is ignored.

Table 3.
Estimated Coefficients of the Alternative Three Models

Term	Null	Fixed-Effects	Random-Effects
Intercept	−0.352 (0.461)	−1.461 (0.466)**	−2.847 (0.605)***
TypeMC		2.217 (0.655)***	4.327 (0.849)***
SD (Intercept STUDENTID)	3.602	3.602	5.423
SD (TypeMC STUDENTID)			2.917
τ (Intercept~TypeMC STUDENTID)			−0.512
SD (Intercept Items)	1.586	1.134	1.469
R^2 Marg.	0.000	0.065	0.131

**p<0.05, **p<0.01, ***p<0.001.*
Note. Standard errors (SE) are represented in parentheses.

Cross-Country Comparison of Item Format Effect

In this section, we perform a cross-country comparison based on the random-effects model, which demonstrated the best fit in the pooled dataset. This approach allows us to examine how the effect of item format varies across each Balkan country. Figure 3 demonstrates that the positive effect of the multiple-choice format (β_{TypeMC}) on item difficulty is consistently observed across all countries; however, its magnitude varies considerably. The MC format significantly increases the likelihood of a correct response in every education system included in the analysis. The strongest effects were observed in Romania ($\beta = 5.4$, $p<0.001$) and Serbia ($\beta = 5.1$, $p<0.001$), followed by Bosnia and Herzegovina ($\beta = 4.7$, $p<0.001$) and Türkiye ($\beta = 4.3$, $p<0.001$). In contrast, Slovenia and Montenegro showed relatively lower—but still substantial—effects ($\beta = 3.3$, $p<0.001$).

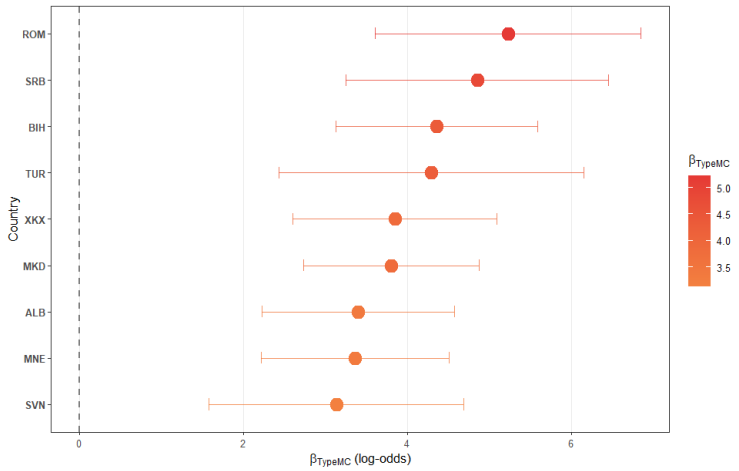


Figure 3. *Country-wise differences in the effects of item format*

Importantly, the confidence intervals (CIs) do not include zero for any country, indicating that the format effect is statistically significant for each country. Varying effect sizes suggest that the extent to which students benefit from MC items differs across national assessment cultures, potentially reflecting differences in instructional focus, test preparation practices, or familiarity with MC testing formats. For example, in Romania and Serbia, students were more than $e^{5.4} = 222$ times and $e^{5.1} = 164$ times more likely to answer correctly when the item format was MC rather than CR. Even in the lowest-effect country (Slovenia), students were still nearly $e^{3.3} = 27$ times more likely to respond correctly to MC items. The proportion of variance explained (R^2) ranged from 8.6% in Türkiye to 23.9% in Bosnia and Herzegovina, indicating notable cross-country heterogeneity in how strongly item format contributes to probability of correct response. Additionally, the negative correlations between intercepts and response format (τ) observed in most countries (e.g., −0.79 in Montenegro, −0.77 in Kosovo, and −0.75 in North Macedonia) suggest that students with lower performance tended to benefit more from MC items.

Overall, these results provide strong evidence that the advantage of MC items is universal across Balkan countries but varies in magnitude, emphasizing the importance of considering response format effects in cross-country comparisons. Failure to adjust for such effects may result in biased achievement estimates, particularly in countries where students are comparatively less accustomed to constructed-response tasks.

Discussion, Conclusion, and Suggestions

In this study, the effect of item format on the probability of correctly responding to items was examined among 4th-grade students who participated in the TIMSS 2023 Mathematics Test across nine Balkan countries. The findings clearly indicate that, in the pooled dataset, students are approximately 76 times more likely to answer multiple-choice (MC) items correctly compared to constructed-response (CR) items. Although this probability varies across countries (ranging from 27 to 222 times), MC items are consistently easier than CR items for all countries included in the study. Results from the random-effects model further reveal that the impact of item format is more pronounced among low-achieving students. Conversely, the effect of item format is weaker for high-achieving students. These findings extend previous research by demonstrating that item format advantages are not uniform but systematically interact with student ability across Balkan systems, creating construct-irrelevant variance that has not been previously quantified in this context.

The effect of item format on mathematics performance is consistent with the findings of Marcq et al. (2024), who examined the PISA 2018 Mathematics Literacy Test. Similarly, Sangwin and Jones (2017) investigated the influence of item format on division and subtraction tasks and reported that students performed better on MC items. In line with these studies, our results also indicate higher student performance on MC items. However, a limitation of the present study is that we employed GLMM procedures based on the Rasch model for all items, without estimating the *c*-parameter (pseudo-guessing) for MC items. Although MC items are generally expected to be easier than CR items in mathematics (Dudycha & Carpenter, 1973), they may appear even easier than they actually are due to students' guessing and option-elimination strategies (Rauch & Hartig, 2010). Future research could address this limitation by employing a 3PL model to account for guessing behavior in MC items. Additionally, a redesign of the study using classical test theory (CTT) with chance-correction procedures could be considered.

Present study examines the effect of item format on student performance only within the Number content domain and the Applying–Reasoning cognitive domains of the Mathematics Test. However, prior research has demonstrated that item format also influences student performance in other areas, such as first-language reading (In'nami & Koizumi, 2009; Ko, 2010; Marcq & Braeken, 2025), L2 listening (In'nami & Koizumi, 2009), medical education (Iñarrairaegui et al., 2022), and spatial reasoning (Shi et al., 2023). Therefore, it can be argued that a meta-analytic synthesis is needed to comprehensively evaluate the impact of item format on student performance across different domains and subject areas.

To examine potential format-related measurement effects, we analyzed 12 items consisting of 6 MC and 6 CR. The analyses provided strong evidence supporting the unidimensionality of the dichotomous dataset. However, one of the fundamental implications of item format is that items may exhibit dimensionality based on their format (Cao, 2008; Zhang, 2016). Hohensinn and Kubinger (2011) reported that when items were grouped according to their format and multidimensional analyses were conducted, the multidimensional structure showed slightly better fit compared to the unidimensional structure. Nevertheless, they emphasized that the differences in AIC and –2LL values were minimal, suggesting that item format did not induce substantial multidimensionality. Accordingly, we did not consider a multidimensional analysis necessary for the 12-item test examined in this study. However, it should be noted that we were not able to model potential testlet effects within the GLMM framework. Therefore, our findings should be interpreted with caution, particularly in light of possible minimal multidimensionality and testlet effects.

We did not model any person-level predictor variable. However, previous research indicates that item format may interact with variables such as gender and intrinsic motivation (Schwabe et al., 2015) or whether the test language corresponds to the student's native language (Abedi, 2002; Abedi et al., 2004). At the item level, complexity and cognitive domain have also been shown to affect the probability of a

correct response (Bulut et al., 2023; Liou & Bulut, 2020). Future analyses may therefore incorporate additional person- and item-level predictors to more accurately explain students' response behavior.

Another key finding of our study is that the effect of item format is stronger among low-achieving students. This clearly suggests that correctly responding to an MC item is not solely determined by the construct being measured (in this case, Mathematics–Number), and that construct-irrelevant variance (CIV) may be present. While MC items are widely preferred due to their practicality and ease of scoring (Rodriguez, 2003), the presence of CIV should raise concerns regarding the validity of inferences drawn from student performance. It should be emphasized that this critique is not intended to discourage the use of MC items. Rather, our focus is on demonstrating that students' performance varies based on item format, implying that undesired variance may contaminate measurement. We therefore recommend that item and test developers carefully consider item format when designing assessments. Specifically, the inclusion of both MC and CR items may pose a risk of multidimensionality and should be carefully evaluated during test development.

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Institutional Review Board Statement: In this study, we reanalyzed a publicly available dataset. Thus, there is no need for an ethical approval.

Data Availability Statement: The dataset can be accessed in https://timss2023.org/data/.

Conflict of Interest: Authors declared that there is no conflict of interest.

Generative Artificial Intelligence Statement: During the preparation of this work, the authors used DeepL Write to correct any grammatical errors in the original text. After it was used, the content was reviewed and edited by the author as necessary and full responsibility for the content of the publication is taken by the authors.

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Creating Individualised Teaching and Learning: Perspectives and Experiences of Primary School Teachers

Jasna Kudek Mirošević[1]

Abstract

Preparation for teaching and learning goes beyond traditional content planning. It involves considering diverse learning styles, digital tools, individualisation strategies, as well as differentiated procedures that respond to the educational needs of each student. The aim of this study is to explore the role of teachers as active creators of individualised learning within the framework of current primary school practice, with a focus on their competences in preparing for teaching and learning. The research focuses on how class and subject teachers perceive their role in creating and implementing support strategies, as well as their possession of the necessary competences.

The goal is to determine whether statistically significant differences exist between class and subject teachers in their self-assessment of (1) the level of competences related to designing and applying individualised methods and adaptations in teaching, and (2) their collaboration with one another in developing and implementing individualised learning, as well as their collaboration with parents.

The central hypothesis assumes that there is a statistically significant difference in the perception between class and subject teachers regarding the creation and application of individualised methods and adaptations, as well as in their perception of mutual collaboration and cooperation with parents as partners in the educational process. For the purpose of the study, a questionnaire was developed to assess the support strategies teachers apply for individualised teaching in inclusive classrooms and their self-evaluation of competences for individualised instruction. The research was conducted on a sample of primary school teachers in the Republic of Croatia (N=159), using a quantitative methodology and a descriptive-comparative method (Mann-Whitney test).

The results indicate a statistically significant difference in the perception of collaboration between the two teacher groups, particularly in the context of individualising instruction for students with disabilities and in cooperating with their parents. Since collaboration enables horizontal and vertical alignment of curricular goals, exchange of experiences, and development of joint pedagogical solutions, the development of teacher competences for modern educational approaches becomes a key component of professional practice. Furthermore, shared planning and experience exchange contribute to a deeper understanding of students' needs and to the more effective development of individualised approaches. Differences in attitudes and levels of competence between the two teacher groups may point to significant implications for the future development of teacher competences in creating support strategies and fostering personalised education.

Keywords: collaboration, inclusive education, individualised approach, support strategies, teachers' competences.

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Introduction

Educational developments in the 21st century have emphasized an inclusive approach as a global priority, requiring critical reflection on systemic reforms and the application of new knowledge in decision-making and problem-solving processes. In response to these shifts, teachers have moved from instructing students on *what* to learn toward guiding them on *how* to learn encouraging comprehension over memorization (Merovci & Cvetkova Dimov, 2024). This paradigm fosters students' deeper engagement with content and promotes skills such as communication, collaboration, leadership, and empathy.

The competencies required for inclusive teaching, particularly individualization and differentiation, manifest in the planning and implementation of personalized curricula, the adaptation of content, methods, and teaching strategies for students with disabilities, and the evaluation (and self-evaluation) of pedagogical effectiveness. These elements are aligned with key international frameworks. For example, the Salamanca Statement (UNESCO, 1994) emphasized that schools must accommodate all learners regardless of their physical, intellectual, social, or emotional needs. Article 24 of the UN Convention on the Rights of Persons with Disabilities (United Nations, 2006) reaffirmed the right to inclusive education and mandated the professional development of teachers to meet this goal. Similarly, the Incheon Declaration (UNESCO, 2015) advocated for equitable and inclusive education, highlighting the importance of enhancing teacher competencies to ensure no student is left behind.

Despite concerns that increased awareness of the complexities of inclusion might decrease teachers' willingness to engage, contemporary findings show that targeted inclusive strategies yield positive outcomes. They foster more inclusive school environments and strengthen professional self-efficacy (Uka, 2024). Teachers who receive appropriate training in inclusive education tend to demonstrate higher confidence and a stronger commitment to collaboration with both professional support staff and parents (Razalli et al., 2021). UNESCO (2017) reinforces this view by asserting that "access to quality education means access to personalized learning" (p. 57), stressing the transformative potential of inclusive pedagogy in addressing disparities in student achievement. Meaningful collaboration between teachers and parents is a key factor in achieving successful inclusive practices. Such collaboration should be built on mutual respect and clear role definition, with parents recognized as active partners rather than passive recipients of information (Hornby, 2000). Inclusive teaching is also strengthened when teachers, particularly those with formal training in special education, participate in multidisciplinary teams that engage in shared planning and open communication with families (Razalli et al., 2021).

Teaching and learning strategies are purposefully structured methods used by teachers to guide and facilitate the learning process. Their goal is not only to ensure knowledge acquisition but also to actively engage students in the learning process, aligned with their individual capabilities and needs. The core objective of individualised and differentiated teaching is to support comprehension, retention, and critical thinking, enabling students to apply knowledge in authentic contexts. Effective instructional strategies are responsive to students' levels of understanding and guide them step by step toward conceptual mastery.

Research on inclusive practices often explores teachers' perceptions of their roles in inclusive settings. Some studies have shown that teachers may resist changes to their daily routines due to the increased preparation required and unfamiliarity with alternative teaching methods (Vlachou & Fyssa, 2016). Others cite insufficient training or lack of confidence when working with students with diverse abilities, often leading to a reliance on traditional methods (Gavish, 2017; Roberts & Simpson, 2016; Strogilos & *Stefanidis,* 2016). According to Lyra, Koullapi, & Kalogeropoulou (2023), teachers often report limited time to address both the academic curriculum and socio-emotional skill development. This time pressure contributes to stress and prevents the balanced development of practical life skills, particularly for students with additional needs. Special education teachers, on the other hand, frequently express greater preparedness and willingness to work with students with disabilities in mainstream classrooms, largely due to their specialized academic background. Gunawardena, Bishop, and Aviruppola (2024) present findings from a study in which teachers underscore fairness and impartiality as essential

components of the learning process, noting that individualised teaching and learning represents a clear and well-articulated pedagogical concept that meaningfully supports these principles. They further argue that individualised approaches create opportunities that are responsive to learners' unique educational needs, strengths, and interests. At the same time, their study reveals notable variation in teachers' perceptions regarding the practical dimensions of implementing individualised teaching and learning. The authors also highlight the inherent complexity of this pedagogical approach, one that appears straightforward at the conceptual level, yet becomes considerably more demanding when operationalized in day-to-day instructional planning.

Ultimately, the quality of inclusive education depends on carefully designed teaching-learning strategies that effectively bridge theoretical content with practical application. Rather than treating students as passive recipients of information, these strategies promote active engagement, increase motivation, and support long-term retention. Effective instructional planning must account for students' diverse learning styles and be tailored to individual academic, social, and emotional needs.

Equally essential is collaboration particularly among teachers, professional associates (such as special education experts, psychologists, and pedagogues), and parents. When these stakeholders engage in shared planning, communication, and joint decision-making, they create learning environments that holistically support all learners, especially those with additional educational needs. Therefore, inclusive education must be understood as a collaborative endeavour grounded not only in methodologically sound pedagogy, but also in sustained partnership and the continuous development of teacher competencies.

Effective teaching strategies take into account the diversity of learning styles, supporting inclusive practices that adapt to individual student needs. Central to this process is the development of teachers' competencies in designing and implementing individualised approaches and adapting instructional methods. These competencies enable teachers to better respond to the varied academic, social, and emotional needs of their students.

Research problem, aim and hypothesis

Although inclusive education is a key objective of many national education systems, including that of Croatia, there remains a lack of clarity regarding how primary school teachers perceive their own competencies in designing and implementing individualised teaching and learning strategies, and in collaborating with colleagues and parents throughout this process. Specifically, there is a research gap in examining whether statistically significant differences exist between class teachers and subject teachers in these areas. Class teachers, who typically spend more time with a single group of students, may feel more confident in applying individualised approaches. Conversely, subject teachers who teach numerous students across different classrooms often face structural and time-related constraints that can hinder collaboration and the implementation of tailored instruction. Despite the relevance of these distinctions, empirical data comparing the two groups remains limited, and existing literature rarely offers robust quantitative analysis. Without a clearer understanding of these differences, it is difficult to design targeted interventions and professional development initiatives that meet the specific needs of each teacher group within inclusive educational contexts.

Despite the growing international consensus on the value of inclusive education, its practical implementation often encounters challenges, particularly in relation to teachers' preparedness to differentiate instruction and to engage in meaningful collaboration with both families and professional associates. Inclusive education presupposes not merely the physical integration of students with disabilities into general education classrooms, but also their active participation, continuous learning progress, and emotional well-being facilitated through individualised support and cooperative teaching practices. Nevertheless, international reports by the OECD (2005; 2019) repeatedly highlight that many teachers feel inadequately trained to address classroom diversity, and that teacher education programs often lack sufficient emphasis on inclusive pedagogy and inter-professional collaboration. Similarly, the Council of Europe (2017) stresses that successful inclusion requires well-structured cooperation among class teachers, subject teachers, special education experts, support professionals, and families. However, such collaboration is rarely institutionalized, supported, or systematically evaluated.

In the Croatian context, although inclusive education is embedded in national legislation and policy frameworks such as the *Guidelines for Working with Students with Disabilities* (Ministry of Science and Education, Republic of Croatia, 2021) there is a marked absence of empirical studies that explore how different categories of teachers (i.e., class versus subject teachers) perceive their own competencies in the individualization of teaching and the extent of their collaboration with other professionals and parents. Class teachers typically have sustained contact with a single group of students, which may facilitate deeper personalization and more frequent interaction with families. In contrast, subject teachers often face fragmented student contact and limited time for the development and application of individualised strategies, which may influence their confidence and perceived collaborative capacity.

In this context, the present study aims to examine whether there are statistically significant differences between class teachers and subject teachers in their self-assessment of (1) their competencies in creating and applying individualised and adapted teaching methods, and (2) their collaboration in planning and implementing individualised learning, as well as with parents as educational partners.

In accordance with the stated research aim, the working hypothesis posits that statistically significant differences exist between class teachers and subject teachers in their perception of their ability to create and apply individualised instructional practices, as well as in their perception of collaboration with professional colleagues and with parents as partners in the educational process.

Method

Participants

The study involved class and subject teachers employed in mainstream primary schools located in the City of Zagreb, Croatia. A total of 159 teachers participated in the research, of whom 93.1% were female and 6.9% male. Regarding their professional roles, 40.3% were class teachers, while 59.7% were subject teachers. In terms of teaching experience, the distribution was as follows: 27.7% of participants had up to 5 years of teaching experience, 11.3% had between 6 and 10 years, 6.3% had between 11 and 15 years**,** 13.2% had between 16 and 20 years, 13.8% had between 21 and 25 years, 14.5% had between 26 and 30 years, and 13.2% had more than 30 years of experience as teachers in schools.

Instrument and Procedure

For the purpose of this research, a questionnaire was constructed to enable teachers' self-assessment of their competencies in designing and implementing individualised teaching approaches and instructional adaptations, as well as their collaborative practices in planning and conducting individualised learning, including cooperation with parents.

The questionnaire consisted of two parts. The first part focused on sociodemographic characteristics of the participants (gender and years of professional experience in the education system). The second part included 19 items, where teachers were asked to indicate their level of agreement with each statement using a four-point Likert-type ordinal scale (1 – Strongly disagree, 2 – Somewhat disagree, 3 – Somewhat agree, 4 – Strongly agree).

The research was conducted online via a Google Forms document. A link to the questionnaire was distributed to school principals and teacher groups, who were invited to participate. At the beginning of the questionnaire, teachers were informed that participation was entirely anonymous and that their responses would contribute to better understanding of inclusive education practices and the implementation of the *Guidelines for Working with Students with Disabilities* (2021). Participants were explicitly encouraged to respond openly and honestly.

The questionnaire items were conceptually aligned with the 2021 Guidelines, which emerged from the curricular reform in the Republic of Croatia and reflect key legislative foundations of a student-centered curriculum. These guidelines provide a framework for individualised planning, implementation, and evaluation of educational processes, aimed at teachers and other school professionals delivering general education programs. They promote individualised approaches to teaching and learning and serve as a guide for selecting optimal forms of educational support for students with additional needs. *"This document offers scientifically grounded principles and procedures for implementing inclusive education, i.e., the inclusion of students with disabilities in the educational process. The Guidelines*

contain instructions on identifying students with developmental difficulties, assessing their educational needs, and planning, implementing, and evaluating teaching and learning processes. The Guidelines also describe the roles of different educational stakeholders and appropriate forms of support for students. They are designed to provide teachers and professional associates with essential information about the key components of an individualised curriculum and direct them to additional learning resources." (p. 5).

Participation in the study was voluntary, and respondents were free to withdraw from completing the questionnaire at any stage without any consequences. Participants were also informed that all data would be used solely for research purposes, ensuring confidentiality. In this way, all ethical principles of research involving human participants were upheld, with full respect for participants' rights and autonomy.

Findings

The analysis of the collected data was conducted on a descriptive and latent level. Alongside inferential statistical methods, key descriptive indicators were also calculated, including the minimum and maximum values (*Min.* and *Max.*), arithmetic mean (*Mean*), standard deviation (*Std. Deviation*). The basic descriptive values of the scale are presented in Table 1.

Table 1.
Descriptive Statistics

Item (Variable)	Min.	Max.	Mean (M)	Std. Deviation (SD)
V1 - I have all the necessary knowledge for working with students with disabilities.	1	4	2.44	.829
V2 - I have all the knowledge required to provide appropriate educational support to students with disabilities.	1	4	2.38	.830
V3 - I have all the knowledge on how to adapt content, methods, and procedures when working with students with disabilities.	1	4	2.48	.808
V4 - I regularly modify and improve differentiated teaching methods.	1	4	2.86	.743
V5 - I have all the knowledge needed to self-evaluate my teaching methods.	1	4	2.54	.783
V6 - I am familiar with the developmental characteristics of students with disabilities.	1	4	2.59	.826
V7 - I regularly conduct educational assessments for students with disabilities.	1	4	2.60	.958
V8 - At the beginning of each school year, I regularly carry out initial educational assessments for students with disabilities.	1	4	2.92	1.110
V9 - I regularly keep records on students with disabilities.	1	4	3.12	.927
V10 - I have all the knowledge necessary to plan and implement Individualised Curricula (IC).	1	4	2.43	.908
V11 - I have all the knowledge regarding the assessment of students with disabilities.	1	4	2.56	.887
V12 - I am familiar with all legal foundations of inclusive education.	1	4	2.49	.903
V13 - I regularly cooperate with professional associates regarding the educational needs of students with disabilities.	1	4	3.06	.949
V14 - I regularly cooperate with the parents of students with disabilities.	1	4	2.81	1.047

V15 - I have a good relationship with the parents of students with disabilities.	1	4	2.93	.985
V16 - I believe that students with disabilities should be included in regular classrooms.	1	4	2.32	.927
V17 - I believe that students with disabilities should be included in special classrooms.	1	4	2.71	.986
V18 - I need regular annual professional development in order to apply individualised approaches and adapt teaching methods.	1	4	3.36	.796
V19 - I believe there are sufficient opportunities for professional development in the field of working with students with special educational needs.	1	4	1.99	.935

Based on the descriptive statistics presented in Table 1, it can be concluded that the measures of central tendency are relatively high, indicating that teachers have a positive self-perception of their role in creating and implementing support strategies for individualised teaching and learning. These findings suggest that teachers generally perceive themselves as competent in developing supportive environments where students not only acquire knowledge but are also actively engaged in the learning process. Such environments foster interactive and meaningful learning experiences tailored to the individual needs of students with varying abilities and learning profiles. As shown in Table 1, the highest mean value was recorded for the item "I need regular annual professional development in order to apply individualised approaches and adapt teaching methods" (M=3.36, SD=0.796). This was followed by "I regularly keep records on students with disabilities" (M=3.12, SD=0.927), and "I regularly cooperate with professional associates regarding the educational needs of students with disabilities" (M=3.06, SD=0.949). These results indicate that teachers are engaged in monitoring and evaluating the progress of students with disabilities, and they report regular collaboration with school-based professional staff. However, the highest-rated item also clearly points to a strong perceived need for ongoing professional development in order to enhance competencies related to individualised instruction. The lowest mean value was found for the item "I believe there are sufficient opportunities for professional development in the field of working with students with special educational needs" (M=1.99, SD=0.935), which reflects teacher dissatisfaction with the availability of relevant training. Additionally, the item "I believe that students with disabilities should be included in regular classrooms" (M=2.32, SD=0.927) reveals possible uncertainty or hesitation among teachers regarding inclusion, potentially stemming from inadequate training, insufficient teaching materials or assistive tools, or limited professional support. Indeed, teachers who have not received quality education or professional development in inclusive practices may lack a clear understanding of the potential and the specific educational needs of students with disabilities, which may hinder their ability to include these students effectively. This can ultimately result in feelings of insecurity, helplessness, or burnout among teaching staff.

To assess the normality of the data distribution, the Shapiro–Wilk test was used. The results revealed statistically significant values ($p<0.05$) for all questionnaire items, indicating that the data deviated from a normal distribution.

Consequently, in addition to descriptive analyses, the Mann–Whitney U test was applied to assess differences between two independent groups (class teachers vs. subject teachers). This test was used to evaluate the main research hypothesis regarding whether there are statistically significant differences in teachers' perceptions of their competencies in designing and applying individualised teaching strategies and their collaboration with colleagues and parents in inclusive education (Table 2).

Table 2.
Mann-Whitney Test

Item (Variable)	Mean	Mean	p

	(class teachers)	(subject teachers)	
V1 - I have all the necessary knowledge for working with students with disabilities.	2.421875	2.452632	0.981799
V2 - I have all the knowledge required to provide appropriate educational support to students with disabilities.	2.421875	2.357895	0.588216
V3 - I have all the knowledge on how to adapt content, methods, and procedures when working with students with disabilities.	2.53125	2.452632	0.469879
V4 - I regularly modify and improve differentiated teaching methods.	2.796875	2.894737	0.541658
V5 - I have all the knowledge needed to self-evaluate my teaching methods.	2.546875	2.536842	0.851431
V6 - I am familiar with the developmental characteristics of students with disabilities.	2.578125	2.6	0.746525
V7 - I regularly conduct educational assessments for students with disabilities.	2.515625	2.663158	0.379619
V8 - At the beginning of each school year, I regularly carry out initial educational assessments for students with disabilities.	2.796875	3	0.200711
V9 - I regularly keep records on students with disabilities.	3.109375	3.126316	0.879446
V10 - I have all the knowledge necessary to plan and implement Individualised Curricula (IC).	2.4375	2.431579	0.965912
V11 - I have all the knowledge regarding the assessment of students with disabilities.	2.59375	2.536842	0.635488
V12 - I am familiar with all legal foundations of inclusive education.	2.40625	2.547368	0.369671
V13 - I regularly cooperate with professional associates regarding the educational needs of students with disabilities.	2.9375	3.147368	**0.047592**
V14 - I regularly cooperate with the parents of students with disabilities.	3.109375	2.610526	**0.004178**
V15 - I have a good relationship with the parents of students with disabilities.	3.109375	2.810526	0.084512
V16 - I believe that students with disabilities should be included in regular classrooms.	2.34375	2.305263	0.912048
V17 - I believe that students with disabilities should be included in special classrooms.	2.6875	2.726316	0.847672
V18 - I need regular annual professional development in order to apply individualised approaches and adapt teaching methods.	3.34375	3.78947	0.732916
V19 - I believe there are sufficient opportunities for professional development in the field of working with students with special educational needs.	2.09375	1.926316	0.191667

Results of the Mann–Whitney U test revealed that class teachers reported significantly higher agreement than subject teachers on the following items “I regularly cooperate with professional associates regarding the educational needs of students with disabilities”, and “I regularly cooperate with the parents of students with disabilities.” These findings support the hypothesis that statistically significant differences exist between class and subject teachers in their perceptions of designing and applying

individualised teaching strategies, as well as in their views on collaboration with colleagues and parents as partners in the educational process.

Descriptive analysis further indicated that class teachers perceive themselves as more competent than subject teachers in providing appropriate educational support to students with disabilities. Specifically, they reported greater confidence in planning and implementing individualised curricula, adapting content and teaching methods, and conducting both evaluation and self-assessment. Statistically significant differences were also observed in greater collaboration among class teachers with school-based professional associates and parents of students with special educational needs (SEN). Moreover, results showed that class teachers held more favourable attitudes toward the inclusion of students with disabilities in regular classrooms and were more optimistic regarding opportunities for professional development in inclusive education. Although the relationship between teachers' attitudes and the successful implementation of inclusive practices has been discussed in previous literature, there remains limited understanding of the underlying factors shaping and sustaining these attitudes (Uka, 2024). Proponents of individualised teaching emphasize the need to provide students with personalized learning pathways and the autonomy to choose content and learning approaches, which contrasts with the traditional model in which teachers dominate instruction (Nagle & Bishop, 2021). Pane et al. (2015) found that students who were taught in personalized learning environments achieved greater academic gains compared to their peers in traditional classrooms.

These results can be interpreted in two complementary ways. First, teacher education on inclusion appears to foster better understanding of students with diverse needs, strengthening teachers' sense of competence and leading to more positive attitudes toward inclusive education. Second, it is possible that teachers who already possess favourable attitudes toward inclusion are more motivated to pursue additional training in this area. As Uka (2024) suggests, professional development may not necessarily cause changes in beliefs, but rather reflect pre-existing attitudes and values. Teachers' concurrent enthusiasm and caution regarding inclusion is understandable. While many teachers demonstrate clear understanding and positive dispositions toward inclusive practices, findings indicate that implementation of individualised strategies in primary schools still lags behind policy intentions. Building a culture of collaboration, supported by role clarity and institutional support, is essential for successful inclusive education. In primary education, class and subject teachers exhibit distinct collaboration patterns with professional associates and parents in supporting students with SEN.

Previous studies suggest that class teachers, who teach multiple subjects to the same group of students, tend to develop in-depth knowledge of their students' learning profiles over time. Their collaboration with specialists is often indirect, relying on professional intermediaries when communicating with parents, especially in cases involving behavioural or emotional concerns (De Boer, Pijl, & Minnaert, 2011). However, direct engagement with parents may be constrained by unclear role definitions, limited time and insufficient training in inclusive education (De Boer et al., 2012). In contrast, subject teachers (e.g., in music, PE, or foreign languages) frequently participate in structured interdisciplinary partnerships, including co-teaching, joint lesson planning, and collaborative development of Individualised Curriculum (Individualised Education Plans - IEPs) (Holmqvist & Lelinge, 2020). Their communication with families typically occurs within multidisciplinary frameworks, enabling shared decision-making and clarity of responsibility. These differing collaboration styles may be influenced by variations in training, role expectations, and self-efficacy. Class teachers, often equipped with targeted professional development, tend to view inclusion as a shared team effort, while subject teachers may feel individually responsible for implementation, potentially reducing their confidence when lacking specific training. Additionally, research shows that teachers with positive attitudes or previous experience with inclusion are more likely to proactively collaborate with both colleagues and families (De Boer et al., 2012). Thus, while subject teachers may engage in occasional or mediated collaboration, class teachers often take a more coordinated and proactive role in working with parents and professionals. To conclude, fostering clarity of roles, mutual respect, and institutional encouragement is crucial to enhancing inclusive collaboration practices across both teacher profiles.Discussion, Conclusion, and Suggestions

The main ideas that emerged in the light of the findings of the research should be explained and discussed. Suggestions can be made according to the findings of the study. In addition, suggestions can be made for future studies and practices that will contribute to the literature.

The main ideas that emerged in the light of the findings of the research should be explained and discussed. Suggestions can be made according to the findings of the study. In addition, suggestions can be made for future studies and practices that will contribute to the literature.

Conclusion

The aim of this study was to examine whether there are statistically significant differences between class teachers and subject teachers in their self-assessment of competencies related to the creation and implementation of individualised teaching strategies and the adaptation of teaching methods, as well as in their mutual collaboration in designing and conducting individualised learning and in cooperation with parents. The results indicate that class teachers rate themselves significantly more competent than subject teachers in providing appropriate educational support to students with disabilities, in planning and implementing individualised curricula, in adapting content, methods, and procedures, as well as in evaluating and self-evaluating their teaching practices. Statistically significant differences were also found in the greater degree of cooperation between class teachers and professional associates within schools, as well as with parents, which points to a stronger perception of educational partnership among class teachers. Negative attitudes toward inclusion are often not a result of opposition to students with disabilities but rather reflect systemic challenges, the need for greater support, better teacher education, and improved working conditions in schools. These findings underscore the necessity for high-quality and accessible professional development programs. Enhancing teachers' competencies must go hand in hand with investments in resources, targeted education, and the development of systemic support for inclusive education.

The results contribute to a more nuanced understanding of the differing perspectives and experiences in collaborative practices between class and subject teachers in inclusive primary education. By highlighting how each group approaches cooperation with professional staff and parents, particularly in relation to students with disabilities, this study offers a valuable framework for designing targeted professional development programs. Understanding these differences is essential for the development of tailored teacher training, institutional strategies for collaborative planning, and fostering inclusive school cultures. The findings emphasize the importance of role clarity, professional identity, and institutional support as critical components of effective collaboration. For future research, these insights may serve as a foundation for longitudinal or comparative studies examining how professional development interventions influence collaborative dynamics across teacher roles. Effective planning of such studies should take into account the contextual diversity of educational systems and the evolving roles of teachers within inclusive education practices. Furthermore, this work opens a path for investigating how school policies and leadership styles impact cooperation between teachers, parents, and professional associates in various educational contexts, as well as exploring specific teaching strategies that need to be developed to enhance the quality of individualised approaches and inclusive practices.

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Microlearning for Vocal Class Students. Innovative vs. Traditional Approach Regarding Work on the Text of a Musical Piece

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Abstract

The paper is about the cohesion between an innovative approach like microlearning and the traditional one while working on a musical piece with vocal students. The results discussed in this work are from an experimental project carried out at the Academy of Music Dance and Fine Arts in Plovdiv, Bulgaria. Parallel to that the same experiment is carried out at the Vocal department of Shandong University of Technology in Zibo, China. Thus the comparison is set in two dimensions - innovative versus traditional approach and multicultural motivational attitude.

Putting microlearning in the centre, the paper aims to explore its effectiveness as an innovative pedagogical approach, specifically when working on an English text of a musical piece and when the target is a vocal class of students. It is extremely important to compare such an innovative method with traditional instructional approaches in connection with pronunciation, articulation and understanding of a text in English for musical-stage arts. Another viewpoint taken into consideration is the students' engagement, motivation and well-being in the process of learning within the vocal class environment. Microlearning modules are formulated and they are tailored for vocal students in general. They are presented in the new way required by microlearning - namely into short, manageable, text focusing "chunks" or units. And last but not least the idea of the paper is to foster and transfer innovative teaching practices outside the limits of the Art Academy in Plovdiv because the present education practices should align with the contemporary digital learning trends and should meet the needs of the modern vocal students who are genuine "digital natives" . (Prensky, 2001)

This paper employs a mixed method research design which combines quantitative and qualitative approaches to evaluate the effectiveness of microlearning, applied in academic environment and to compare it with the traditional methods used to the moment in vocal instruction.

Keywords: microlearning, vocal class, traditional, innovative, multicultural

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Introduction

Microlearning has been experimented as an innovative instructional approach mainly in science education. To the moment it is not popular in the sphere of Arts education. It is challenging, yet highly motivational to try it when working with the vocal class on the verbal text in musical-stage arts. The most recognizable features of microlearning are concise focused chunks of information that can be used at any time, everywhere and under a lot of circumstances. Such features are extremely attractive for vocal classes preparation because of the limited practice time they have when working on a musical-stage piece and also because of the different levels of the English language command for each student in the vocal class. Moreover the students' initiative is encouraged and they gain confidence creating their own learning plan and putting themselves in the centre of the educational process.

The need of enough empirical research regarding the application of microlearning in the education of Arts students made the data received have a considerable impact on the innovations implemented during the classes. They enhanced the beliefs about the development of linguistic as well as performing skills. Of great importance is the fact that the experiment was carried on in two institutions for a Higher Education on two continents. The transfer of ideas is one of the major aims this experiment has achieved. The results stated in the paper show the facts of combining highly innovative approaches like microlearning with traditional and successful approaches when working on the text of a musical-stage piece.

The transfer of ideas beyond the boundaries of the Art Academy in Plovdiv includes the formulating of microlearning modules which are tailored for vocal students at universities and conservatories that abolish the existing practice and offer microlearning methods when working on the articulation and pronunciation of the English text of a musical piece. Part of it also includes the contextual positioning of the ideas that the lyrics of a song or the libretto of a musical-stage piece want to share with the audience.

Literature Review

The concept of microlearning started its popularity in business environment. It was created for the needs of the business with its hectic lifestyle and the lack of time to learn. They had to think of something that fits in the daily life of the people doing business and at the same time willing to learn. Later microlearning started being used for academic purposes also but as it was already mentioned mainly in the field of science. There are a lot of definitions but all in all the literature agrees that microlearning is a training strategy that divides the educational content into "chunks" or with other words they are small concise focused micro parts that keep in themselves the essence of the material taught. Even the etymology of the term leads to the basic characteristic features of the form of the material taught. Micro is equal to something really small and then we have learning like a process of knowledge or skills acquisition. Among the many definitions of microlearning the project experimenting microlearning at the Academy of Music Dance and Fine Arts in Plovdiv chose the following definition by Donald H. Taylor: “Learning from content accessed in short bursts, content which is relevant to the individual, and repeated over time to ensure retention and build conceptual understanding.” (Taylor, 2017).

The forms of conducting microlearning could vary from several seconds to a few minutes. They can be a short text message with a concentrated information in it, a short video discussing a certain problem, in fact taking the role of a micro lecture, thus avoiding the typical boredom in academic auditoriums and at the same time preserving the interest on the topic discussed. Moreover, the videos are part of everyday life of all youngsters no matter if they are academic students or not. In fact this form of presenting the academic content is a try to mirror the lifestyle of the above mentioned “digital natives” or Gen Z.

As well as in Europe, microlearning as an educational approach in an academic environment is new for China also. It is interesting to highlight the differences according to Chinese researchers due to the cultural peculiarities. In China the traditional education is mainly focused on the figure of the teacher while microlearning is done via videos or audios or podcasts and they are the carrier of the educational content. In this respect for the process of learning the educator only chooses the content and gives the instructions to the student and in fact the centre is transformed and the student goes into the centre instead of the teacher. In traditional Chinese educational practice the student has a passive role but for

microlearning s/he is the active figure and the traditional face-to-face teaching is substituted by distance learning. According to the Chinese researchers cited in this paper the students are able to learn more effectively because the modern technologies are involved in the process of education and the students accept them as a part of their modern life and practically the education takes the form of something close and natural for them. (Chang et al. , 2015)

Method

The study employs a mixed-method research design. It can be witnessed as a combination of quantitative and qualitative approaches. The above cited approaches are used in order to evaluate the effectiveness of microlearning for vocal class students when working with musical-stage piece in comparison to the traditionally used methods in vocal instruction.

The participants are vocal class students from the Art academy in Plovdiv, Bulgaria and vocal class students from the Vocal department of Shandong University of Technology in Zibo, China. The students in Bulgaria are both Bachelor and PhD Majors. They come from Bulgaria, Turkey and China. The multi cultural class provides an opportunity to compare better the innovative microlearning approach with the traditionally used one for vocal training in a number of countries

The students in Zibo, China are all Bachelors and all of them are from China. In fact they all will feel the difference between the innovative microlearning approach within the same traditional system of vocal training in China they are used to. All the students in both higher education institutions take part in the experimental project voluntarily. They all are even eager and curious to try the new educational strategy and willingly participate not only in the artistic activities but also in the questionnaires and interviews connected with them. All the ideas of the team of researchers who carried out the experiment are in unison with the ethic guidelines and comply with data protection. Throughout the whole experiment the data confidentiality and anonymity were strictly maintained.

The participants are divided into two groups: an experimental group and control group. Both groups have equal number of students in them - nine in each group in Bulgaria and 15 in each group in China. Thus the students taking part in the experiment in Bulgaria are 18 in total and those in China are 30 in total.The experimental group receives microlearning based instruction mainly combined with some traditional approaches while the control group follows fully the traditional teaching approach existing to the moment.

As a research design the comparative-experimental approach is chosen. It aims to measure the outcomes of both teaching methods - traditional and innovative. The observations were carried out throughout two academic terms in the course of one academic year.

The participants from the Art academy in Bulgaria and the University in China work on the same musical pieces. On the other hand both experimental and control groups work on the same musical pieces ensuring comparability in the repertoire and difficulty level.

The following pieces were chosen to work and experiment on the correctness of pronunciation of their text: *By a Fireside* /Thomas Jones, Jr. - words; Elinor Remick Warren – music/ and *After* / Philip Bourke Marston – words; Edward Elgar – music/.

By definition in microlearning the content taught is delivered in small "chunks" focused on the basics and ready to use at any time and according to the need of the student. The absolute freedom to choose time, place and repetition is an appealing factor for Arts students who are creative, lively and ‘out of the box’ people. And that is why at the Art Academy in Plovdiv the learning content is divided into short, focused digital units. Keeping in mind the strong figure of the teacher in the educational process in China, the researchers there choose to divide the learning material also into short, focused in-class modules.

The separate modules or "chunks" of the educational content include vocabulary work, pronunciation practice and literary context. The vocabulary work is of great importance for the students to understand and analyze the text of the musical piece and in that way to go deeper in the ideas of the author and the messages the piece conveys to the audience. Together with the historical context the good understanding of the text is one of the prerequisites to a good vocal performance. “Ideal singing is an emotionally

expressive event involving the word, its meaning and feeling, and its musical environment. Thus, it is essential that the singer be keenly perceptive of and sensitively receptive to the word, that he possess a fully developed linguistic awareness." (Koza, 2009, p. 25, quoting Foster). Another researcher and actively performing tenor Ivaylo Mihaylov argues that the unity between lyrics and music is a specific feature of all the vocal genres. "В тях връзката между текст и музика е обективно заложена поради факта, че те се изграждат върху основата на текст - от либрето, словесен текст в музикално-сценични жанрове /опера, оперета, мюзикл/ през пространните текстове, често върху Библията, в крупните вокално-инструментални творби, като оратории, меси, кантати, до поетичните текстове в основата на хоровите песни и камерните солови вокални творби /песни, романси, балади /."("In these works, the connection between text and music is intrinsically embedded, because they are built upon a textual foundation—from the libretto and the verbal text in musical-stage genres such as opera, operetta, and musical, through the religious texts, often based on the Bible, found in large-scale vocal-instrumental compositions like oratorios, masses, and cantatas, all the way to the poetic texts underlying choral songs and chamber solo vocal pieces such as songs, romances, and ballads."). (Mihaylov, 2023, p. 61).

The other objective when working with the vocal class on the text of a musical-stage piece is building correct articulation of the sounds that should be sung. All vocal coaches pay special attention to correct articulation and require it strictly from their students. "In other words: over the course of intensive vocal training (which typically includes articulation/diction work among other components), singers showed measurable increases in both their pitch range (higher highest notes) and sound pressure level (louder, stronger voice)." (Mendes, Rothman, Sapienza, & Brown, 2003, p. 531)

Following that idea the correct and clear pronunciation is an ultimate aim for each student from the vocal class. That is why a special attention is paid on the "chunks" presenting specific phonetic sounds and techniques for their acquiring. A focus is put on the articulation of the sound [r] and [l] - sounds that are hard to pronounce correctly, especially by the international students at the Academy. That is why the first two modules practice them using different phonetic exercises. Then the intradental [δ] and [θ] are practiced because they are really specific for the English phonetic system and they are absent in most of the native languages of the vocal students taking part into the research. Another sound, although not so much specific or difficult to articulate, but giving trouble to some of the vocal students from Asia, Russia, Ukraine and Moldova is [w] and there is a chunk about it, paired with successful techniques to achieve its correct production. The last module, "chunk", for the first stage of the experiment is dedicated to [æ] together with a general review of the sounds and techniques practiced to that moment.

The second level of the microlearning experimental project starts with pronunciation modules on the sounds practiced in the first part but now specifically where they can be found in the text of both songs with the attention focused on [w] and the diphthong [ou]. The second "chunk" of the educational content is about special pronunciation techniques for a better vowel production. The students are asked to make an audio after the end of the personal practice and submit it to the project team for evaluation. Based on that feedback, "chunk" number three repeats the practice on [r] and [l] but this time they are pronounced together with part of the surrounding text from the lyrics. All the microlearning activities to that point prepare for the fourth microlearning "chunk". It is a rhythmic reading of the text of both songs following the piano accompaniment sent in the shared Messenger group. Then again the vocal students from the experimental group are asked to send a video as a feedback.

After monitoring and discussing the gathered feedback to the moment with the team the next module of the microlearning experiment is prepared. It is pronunciation practice of the mispronounced sounds explaining the mistakes and giving strategies to overcome them. The next "chunk" coincides with the physical vocal practice done with the vocal coaches in person. It expects from the vocal students to repeat the whole text of the song as much as needed after the model and to pause the recording at the moments they personally feel difficult and practice together with the audio. The final microlearning "chunk" is in fact a review of the 10 done throughout the whole experiment. Its aim is to refresh the students memory as well as to consolidate everything practiced to the moment. Thus we have five microlearning modules for the first stage of the experiment and six microlearning modules for the second stage.

All the microlearning modules /chunks/ are delivered through mobile applications. In fact the short audio materials are used to encourage self-paced learning. Short video or audio materials are used for a feedback so that throughout the whole process of experimenting the team of researchers keeps a trace of the process for each individual in the program. In fact although the students from the vocal class are placed in the centre of the educational process, behind the scene their instructors control and lead the work on the musical-stage piece. They support the initiative of the students and support them for each step they take to improve their own vocal performance. It turns to be highly motivational for the students to try, to experiment, to listen to their own mindset and work accordingly. On the other hand it turns to be equally highly motivational for the researchers to see their ideas take shape and be transformed and sent from the typical domain for microlearning, namely business and science, to the domain of arts.

Of course, talking to the moment about microlearning strategies while working with vocal students on the text of a musical-stage piece does not mean that they are used in isolation. On the country, they are used in combination with traditional practices that have proved successful. Such a practice is the CLT /Communicative Language Teaching/ method. The component Writing is excluded in the traditional language instruction for vocal students as irrelevant to the final goal and because of time pressure. This method relies mainly on teacher-led explanation, rehearsal and memorization of the text. It is centered on the figure of the teacher and is connected to his/her professionalism, language expertise and last but not least preference of teaching mode. The emphasis is put on holistic learning through repetition and direct instruction.

The data collection methods of the experiment include pre-test and post-test assessments. They aim to evaluate students' comprehension of the English text of the song lyric. Of major importance during the test conducting are the linguistic skills of each student of the vocal class. The correct pronunciation, articulation, intonation are tested. The tests also check the memorization accuracy as well as the expressive interpretation of the text. Because the motivation of the vocal students, their learning satisfaction is of great importance for the experimental project, they are evaluated through students' questionnaires and interviews. In fact the centre of all the microlearning activities is the perceived effectiveness of applying microlearning when working on the text of a musical-stage piece in an academic environment connected with arts. That is why the majority of questions in the questionnaires and interviews are connected to that. Last but not least the teachers' reflections also play a major part in data collecting. Students' progress is meticulously observed and recorded together with the adaptability and teaching efficiency throughout the whole period.

The data analysis comprises quantitative data and qualitative data. The quantitative data are analyzed by means of using statistical methods in order to compare linguistic and vocal performance between control and experimental groups. The interview responses, teacher observations and so on belong to the qualitative data which are analyzed thematically to identify and define patterns in attitude, motivation and learning experiences among the participants in the experimental project.

It is definitely necessary to mention that everything done about the project to experiment microlearning for vocal class students is on the basis of the literature available for implementing microlearning in business and science. The strategy and the model of the experiment keep the basic ideas of the microlearning approach but are applied systematically keeping in mind the logics of the traditional training when working on the text of a musical-stage piece. The limitations of the almost non-existent research literature on microlearning in the domain of arts are overcome by professional experience and a lot of discussion among the research team. In some cases the decisions are taken 'on spot' following the logics of the working process. Hopefully in the future the number of microlearning experiments for arts can grow up and spread outside the boundaries of vocal training, thus supplying more data for a high quality research.

Findings

The acquired results are encouraging and motivational and they are not only due to the mindset for success in the research team and the participants in the project experimenting microlearning when working on the verbal text of a musical-stage piece in academic environment. The results prove that the text comprehension is significantly improved as well as its interpretation. The vocal students from the experimental group show better pronunciation compared to their peers from the control group. They

have deeper understanding of the emotional context and the linguistic nuances of the musical pieces chosen to practice compared to the students using traditional instruction methods. Enhanced retention and application of the material practiced is demonstrated by the experimental group. Its learners apply correct articulation more effectively during vocal performance in the "singing battles" at the end of the experiment. The "battles" are between both groups - control and experimental and show that learners exposed to microlearning "chunks" possess better pronunciation than those who have not been exposed to microlearning strategies.

Undeniably the positive impact on vocal expression and performance is clearly felt via improving the textual understanding of the musical piece. The techniques forming correct articulation and applied using microlearning modules are expected to lead to more expressive and communicatively effective vocal performance of the rehearsed songs. In fact microlearning ensures a more efficient learning process, it is more time-efficient even effort-efficient and flexible because it enables students to master all the textual aspects of a musical piece in short, more concentrated and focused sessions without losing the quality of the instruction.

As it was mentioned above, microlearning places the student in the centre of the educational process. Such a placement is connected to the development of self-regulated learning skills. The vocal students from the experimental group are likely to develop better habits in self-assessment, goal setting and independence study compared to their co-students from the control group. All in all microlearning as an innovative format boosts both students' and teachers' motivation and engagement while working on the verbal text of the musical-stage piece. The short, focused, interactive ready-to-use everywhere "chunks" make microlearning a preferable strategy for the young modern students. The students' willingness and motivation are transferred to their educators and the research team is equally thrilled to prepare and apply the innovative method of teaching.



Photo1. Traditional Method /author's archive/

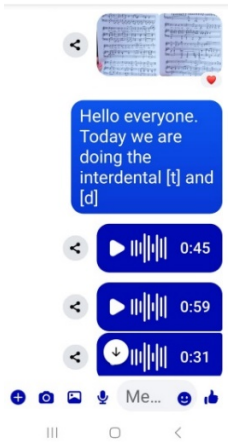


Photo 2. Innovative Method / author's archive/

Discussion, Conclusion, and Suggestions

All the facts exhibited in this study confirm the idea that microlearning as a method proves to be highly effective for developing students' understanding and interpretation of the English text in vocal music. The participants from the experimental group who are exposed to microlearning strategies demonstrate higher levels of textual comprehension and its expressive integration in performance than their peers from the control group who use traditional methods for instruction. The vocal performance of the participants belonging to the experimental group during the "singing battles" is more expressive and authentic due to the extra focusing on textual analysis. Not only the vocal performance of the experimental group is better than the control group, their diction is clearer and the communication of meaning to the audience is greatly improved. A deeper emotional connection with the ideas of the lyrics of the song can be observed as well.

At the beginning the comparison between the innovative and traditional training methods for students from a vocal class is set as a major objective of the study. The results suggest that it is best to combine microlearning as an innovation with a traditional vocal instruction. Such a blended approach can certainly modernize and enrich the teaching process, it can also make the work on the text of a musical-stage piece more efficient and adaptable to the contemporary learning environment. It is suitable for online or hybrid formats.

The motivation factor has been extremely important when working with Arts students because they are talented, curious and colourful 'out of the box' personalities. First they need to be provoked and challenged in order to improve their engagement with the learning process and their motivation to work better. The short, easily accepted learning units encourage a regular participation and reduce the cognitive overload. The mindset for success turns from a cherished perspective into a really existing aim that can be set and fulfilled for a short period of time, thus creating a sense of achievement through incremental progress.

The microlearning experimental project aims to generate best practices and transfer ideas in vocal pedagogy while integrating the innovative microlearning strategies into the traditional vocal training that gives good results to the moment. The first steps have been done - the students from the Vocal Department of Shandong University of Technology in Zibo, China have been working parallel to their peers in Bulgaria with a slightly transformed program. It proves the argument that each educational frame can be transformed and adjusted due to the cultural peculiarities and the educational system of each country. The project is valuable for its data-driven insights that confirm a future curriculum design because such a design allows certain changes if preserving the general ideas of microlearning, namely the educational content to be presented into short, focused "chunks" that can be used at any time by the learners.

It is recommended that microlearning be further tested with a bigger number of participants and in different domains of arts where the work on a foreign language text is needed. It is advisable this innovative approach to be further studied and implemented within bigger areas of vocal pedagogy. Together with the text and context analysis and pronunciation practice, a repertoire analysis can be included to broaden the horizons of microlearning. The applicability of the innovation is a continuation of creating digital microlearning resources and providing valuable tools for both sides of the academic desk - educators and Arts students. It is also advisable researchers to study different age groups of students dealing with arts. The author is aware of the fact that the following work is only the beginning of a cycle of research projects which aim to study the peculiarities of microlearning and the options to implement microlearning into the educational process of the vocal class students when they work on the verbal text of a musical-stage piece. The continual improvement and enriching of the microlearning materials could provide valuable tools for both educators and vocal students.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the research team members of the experimental project and that all the responsibility belongs to the article author in case of all ethical violations.

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International Collaboration and Community Interpreting Practices in Disasters

Coşkun Doğan[1]

Abstract

The world is a planet where disasters or disasters that closely affect the living creatures living on it occur. Disasters are events that people are unable to find solutions in their own living spaces and normal life is interrupted, out of control, causing great loss of life and property. These events are usually caused by nature's own movements. Disasters may be unavoidable events; however, it is possible to be a resilient society against disasters. The way to do this is to take precautions and increase the level of awareness of the society through awareness training.

Countries where disasters occur are often unable to cope with the destruction caused by the disaster alone. In these cases, international co-operation and support gain great importance. Many international organisations established for disasters come to disaster areas and provide not only search and rescue services but also various social aids. In order for these organisations to work effectively and beneficially, a common communication language is needed. Accurate and effective linguistic communication contributes greatly to the rapid and efficient delivery of international aid to disaster-affected communities. In this respect, Disaster Interpreting in Disaster (ARF), a community interpreting-based practice, has been developed. ARÇ has played an important role by providing linguistic communication services to international foreign aid teams, especially in major disasters that have occurred in Turkey in recent years.

The aim of this study, which is based on a literature review, is to emphasise that accurate and effective linguistic communication is an indispensable element for the timely and effective provision of all kinds of services in the international solidarity process in disaster situations. In this context, it is argued that the use of community interpreting, which is carried out verbally, in disaster conditions, provided that the necessary disaster training is received before the disaster, will both contribute positively to the international solidarity process and mediate the establishment of a healthy communication between international teams with different cultural backgrounds and local people.

Key Words: Translation, Community Interpreting, Disaster, Disaster Awareness

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Introduction

Throughout human history, natural disasters have been among the events that profoundly affect the lives of individuals and societies. Nature-based disasters such as earthquakes, floods, wildfires, and landslides cause severe destruction not only to the physical environment but also to social structures and order. The loss of life and property resulting from disasters can disrupt social life, lead to psychological problems, and create collective trauma. For this reason, disaster management should not be limited solely to physical intervention; effective communication strategies must also be integrated into this process.

In coping with disasters, especially in situations where national resources are insufficient, international aid and cooperation are of vital importance. However, for such assistance to be effective in the field, accurate, rapid, and culturally appropriate linguistic communication must be established between the local population and foreign relief teams. In this context, community interpreting emerges as a crucial need during disasters. Immediate, accurate, and context-sensitive interpreting services support the timely and effective implementation of relief activities.

Developed in Türkiye to address this need, the Disaster Guide Interpreting (ARÇ) initiative establishes an effective communication bridge between local communities and international teams in disaster-affected areas, thereby filling a significant gap in disaster management. Nevertheless, the effective functioning of this system depends not only on linguistic competence but also on the active involvement of trained interpreters equipped with disaster awareness.

In the Turkish context, it is observed that comprehensive and institutionally grounded research on community interpreting practices in disaster processes remains limited. This shortcoming highlights the necessity of an interdisciplinary perspective to strengthen communicative solidarity during disasters. Based on a review of the relevant literature, this study examines the critical role of linguistic communication in disaster situations and offers an alternative perspective on international cooperation and community interpreting in disaster contexts. In addition, it evaluates the function of community interpreting in international humanitarian aid processes. Drawing on the Disaster Guide Interpreting (ARÇ) initiative, the study aims to propose solutions to communication problems that may arise under disaster conditions.

The Concept of Disaster and Its Social Impacts

Disasters are events that disrupt the daily flow of life in societies, cause serious loss of life and property, and are difficult to cope with using existing local resources. The term *disaster* refers not only to the event itself but also to the negative impacts it creates on society (Oktay, 2021: 1). Such events are not limited to physical destruction; they can also have severe consequences in social, economic, and psychological domains. For this reason, the phenomenon of disaster must be approached from a multidimensional and interdisciplinary perspective (see afad.gov.tr).

In general terms, a disaster—whether natural or human-induced—is a condition that leaves destructive effects on society. Disasters are examined under three main categories (Öcal, 2018: 52):
Natural Disasters: Disasters arising from natural events such as earthquakes, floods, landslides, avalanches, storms, and droughts.

Technological Disasters: Disasters resulting from human-made technological risks, such as industrial accidents, nuclear leaks, and failures in infrastructure systems.

Human-Induced Disasters: Events directly caused by human activities, including terrorist attacks, wars, migration movements, and unplanned urbanization.

Although disasters are often perceived as isolated events, they may cause cascading effects and trigger other disasters. Therefore, the impacts of disasters should be evaluated not only in terms of their physical dimension but also together with their social, environmental, and economic consequences. For example, an earthquake may lead to secondary disasters such as fires, gas leaks, floods, or environmental pollution (Altun, 2018: 3). The extent of damage caused by a disaster may vary depending on the severity and

duration of the event, as well as the response capacity. In all cases, however, post-disaster societies face serious social, economic, and psychological challenges.

From a social perspective, one of the most striking impacts of disasters is displacement, temporary shelter problems, and disruptions in access to basic services. This situation can have even more devastating consequences, particularly for children, the elderly, persons with disabilities, and other vulnerable groups. Moreover, disasters may weaken social bonds, undermine the sense of solidarity, and reduce overall feelings of security (Altun, 2018: 2).

Economically, the effects of disasters are felt in both the short and long term. Agricultural production, industrial activities, and the service sector are disrupted. Damage to critical infrastructure systems such as transportation, energy, water, and communication can lead to economic stagnation and loss of labor. In addition, the post-disaster reconstruction process imposes a significant financial burden and causes substantial increases in public expenditures (Marangoz & İzci, 2023: 3).
From a psychological standpoint, the effects of disasters on individuals may be more long-lasting and persistent than physical damage. Psychological problems such as trauma, fear, panic attacks, insomnia, depression, and post-traumatic stress disorder (PTSD) are frequently observed. Moreover, these effects are not limited to individuals directly affected by the disaster; they may also impact those indirectly exposed or those who witness the event through the media. Therefore, post-disaster mental health services are of critical importance (Avdar & Avdar, 2022: 10).

In conclusion, disasters are not merely natural events but social phenomena that profoundly affect the structure of society. Being prepared for such events that can impact all segments of society, minimizing risks, and developing effective crisis management practices are of great importance. This is only possible through a comprehensive, holistic, and sustainable disaster management approach (www.afad.gov.tr).

Social Solidarity and Imece

The concept of *İmece*, mentioned in *Divanü Lügat'it-Türk*, traditionally refers to a form of cooperation based on the principles of social solidarity, mutual assistance, and collective labor. With deep historical roots in Turkish culture, *imece* is founded on individuals voluntarily coming together to share their labor for a common purpose. This practice represents not only an economic or physical form of cooperation but also a cultural value that strengthens social bonds and reinforces a sense of collective belonging (Kara, 2016: 380–381).
In today's world, characterized by increasing globalization and interdependence, the understanding of *imece* has transcended national borders, giving rise to the concept of "international imece." International imece refers to the cooperation and solidarity of individuals, institutions, and societies from different countries in line with shared humanitarian values. This concept has gained particular significance in fields such as disaster management, humanitarian aid, health, education, and environmental protection (Çoban, 2022: 120).

With population growth, the division of labor has expanded, individuals have become specialized in specific fields, and society has gradually evolved into a complex structure based on mutual dependence (Durkheim, 2020: 213). This transformation has also reshaped the meaning of *imece*. While traditional *imece* constitutes an example of mechanical solidarity—based on members of the same community sharing similar tasks—in modern societies, *imece* has taken the form of organic solidarity, where individuals and institutions from different areas of expertise cooperate toward a common goal (Çoban, 2022: 121).

This shift becomes particularly evident during disasters. In post-disaster processes, the voluntary assistance of local communities reflects the traditional understanding of *imece*, whereas the coordinated actions of public institutions, non-governmental organizations, healthcare teams, and international relief organizations embody Durkheim's concept of organic solidarity. Individuals with different roles and areas of expertise come together on the basis of mutual interdependence to mitigate the impacts of disasters and to restore social order (Doğru, 2024: 1186).

Therefore, disaster *imece* can be regarded as a form of social solidarity that integrates the emotional and cultural dimensions of mechanical solidarity with the division-of-labor-based structure of organic solidarity. In this context, *imece* is not merely a cultural practice of mutual assistance but has also

become a fundamental mechanism for social reconstruction and collective recovery during times of crisis.

International Disaster Aid and Solidarity

Natural disasters often create humanitarian crises far beyond what a single country can manage on its own; therefore, post-disaster relief and response efforts require solidarity at the international level. International aid systems are based on coordinated cooperation among states, international organizations, and civil society institutions. This solidarity not only responds to humanitarian needs but also strengthens the trust and moral resilience of disaster-affected societies. International *imece* refers to the transformation of humanitarian aid and support processes into an interwoven network of solidarity through the voluntary and selfless cooperation of local communities and civil society organizations in disaster-affected areas (Baysal & Akın Çelebi, 2025: 148).

In the period following disasters, the process of international *imece* in the post-disaster phase refers to the coordination of requested assistance. International institutions rapidly intervene in cases where local capacity is insufficient, providing search and rescue operations, healthcare, shelter, food, and logistical support. In the case of Türkiye, following the 2023 Kahramanmaraş-centered earthquakes, numerous actors such as the United Nations, the Red Cross, NATO, as well as state institutions and non-governmental organizations, mobilized together, clearly demonstrating the importance of coordination (Karaman, 2025: 81–85).

After disasters, international organizations provide assistance to disaster victims in all respects and stand in solidarity with them. These organizations assume critical roles at different stages of disaster response. While the United Nations and its affiliated agencies offer guidance and strategic coordination, the Red Cross and Red Crescent Movement (IFRC) plays an active role on the ground in key areas such as search and rescue, food provision, shelter, and healthcare services (Doğan, 2019: 87). In addition, through "aid diplomacy," a form of crisis diplomacy, the political and humanitarian depth of international solidarity is further strengthened. For instance, as evaluated by SAM Papers, Türkiye became a focal point of international aid diplomacy following the 2023 earthquake, adding a new dimension to humanitarian diplomacy (Akıllı, 2023: 14).

Within this framework, cooperation between institutional and civil actors ensures that international coordination efforts are effective, rapid, and inclusive. This systematic and interdisciplinary approach contributes to the establishment of a sustainable foundation for solidarity in crisis management.

The Importance of Communication in Disasters

Disasters not only cause physical destruction but also create extraordinary situations in which access to information is limited, uncertainty intensifies, and panic prevails. In such moments of crisis, effective communication does not merely facilitate the transfer of information; it becomes a fundamental tool that strengthens social solidarity, facilitates crisis management, and guides society through the process of recovery and reconstruction. From healthcare services and shelter to search and rescue operations and psychosocial support, a lack of communication in any of these areas can pose serious risks (Birol & Gündüz, 2024: 103).

The importance of communication during disaster periods is not limited to the transmission of technical information. The clarity of the language used, the cultural appropriateness of messages, and the ability of conveyed information to build public trust are at least as important as the content itself. At this point, linguistic and cultural barriers, in particular, can reduce the effectiveness of communication and hinder crisis management (www.altalang.com).

In the chaotic environment of disaster zones, communicating with communities that speak different languages is of vital importance. This becomes even more pronounced in countries like Türkiye, which have multicultural and multilingual populations. Indeed, during both the 17 August 1999 earthquake and the 6 February 2023 earthquakes, communication problems between search and rescue teams operating in the field and disaster victims demonstrated that such deficiencies directly affect human lives. In these situations, the involvement of interpreters or volunteers trained in disaster interpreting

has both ensured the flow of information and minimized misunderstandings that could arise in disaster settings (Tavil et al., 2025: 05).

Moreover, individuals with communication impairments (such as those who are hearing-impaired, on the autism spectrum, or experiencing speech disorders) are often overlooked in disaster management processes. The specific communication methods required by these individuals (for example, sign language interpreting or symbol-supported communication boards) should be explicitly included in disaster preparedness plans. Otherwise, access to assistance for these individuals may be severely restricted (Sur, 2023: 1).

Linguistic translation alone is not sufficient in communication; messages must also be shaped in accordance with the cultural context. Sensitivity to cultural differences ensures that messages are correctly understood. For instance, perceptions of disasters and the terminology used may vary significantly across cultures, potentially leading to fatalistic or inappropriate reactions during crises. All of these factors make it necessary to design disaster communication strategies with cultural intelligence. In disaster communication, it is not enough to translate words accurately; the information must also be presented in a culturally appropriate manner.

In addition, symbols, colors, visuals, or metaphors may carry different meanings across cultures. Therefore, during crises, it is of great importance that both written and visual materials are designed with sensitivity to the cultural values of the target audience. This approach not only enhances the effectiveness of communication but also ensures that individuals in disaster-affected areas can participate in the process without feeling excluded. When trust in information decreases during times of crisis, the impact of misinformation and disinformation becomes even stronger. For this reason, communication must be sincere, sensitive, and inclusive in order to involve all segments of society in the process (Tavil et al., 2025: 217).

Effective communication in the face of disasters means not only providing information but also empathizing with individuals, building trust, and involving all segments of society in decision-making processes. Therefore, removing linguistic barriers and taking cultural differences into account should be an integral part of disaster management plans. Multilingual and culturally sensitive communication strategies to be developed will accelerate both physical and emotional recovery in times of crisis. In this context, community interpreting plays a critical role in ensuring the sustainability of communication during crisis situations.

Definition and Characteristics of Community Interpreting

Translation Studies, which originated as a subfield of linguistics, became an independent academic discipline particularly from the 1980s onward through its interdisciplinary connections with various scientific fields. As a result of these developments, Translation Studies has been divided into two main areas—written translation and interpreting—under which various subfields have emerged. One of the significant subdisciplines that developed within the field of interpreting is community interpreting (Doğan, 2020: 75).

Community interpreting is a form of oral translation carried out in public service settings with the aim of facilitating communication between different linguistic and cultural groups. This type of interpreting takes place in public service institutions such as hospitals, courts, schools, social service centers, and police stations (Kurultay & Bulut, 2012: 79). A community interpreter is not merely a mediator who transfers messages between two languages, but also a communication facilitator equipped with intercultural awareness and empathy skills. Often carried out on a voluntary basis, this interpreting activity is governed by specific ethical and professional principles. According to Doğan (2015), the main characteristics of community interpreting can be summarized as follows:

- **It supports two-way communication:** It enables effective communication for both the service-providing institution and the service recipient.
- **It provides intercultural mediation:** It manages the communication process by taking into account not only linguistic differences but also cultural divergences.

- **It adheres to the principles of neutrality and confidentiality:** The interpreter protects information confidentiality and maintains an impartial stance.
- **It carries ethical responsibility:** It ensures balance between parties and acts in a manner that prevents violations of rights (Doğan, 2015: 66).

The importance of community interpreting increases especially during periods of crisis. In extraordinary situations such as natural disasters, wars, mass migrations, and pandemics, access to accurate and timely information becomes a vital necessity. In such contexts, language barriers may prevent individuals from accessing fundamental rights and services. Community interpreters play a key role in overcoming linguistic, cultural, and psychological barriers in crisis environments. According to Pöchhacker (2008: 30), the responsibilities of community interpreters in emergency situations can be grouped under the following headings:

- **Transmission of vital information:** Ensuring the accurate interpretation of critical announcements such as disaster warnings, health directives, and evacuation information.
- **Equity in access to services:** Enabling individuals facing language barriers to access services such as healthcare, shelter, and food.
- **Enhancing social trust:** Mediating trust-based communication between foreign nationals and local authorities.
- **Trauma awareness:** Contributing to the emotional support of individuals experiencing high levels of stress.

In this context, community interpreters are expected not only to possess advanced language proficiency but also to be equipped with interdisciplinary competencies such as crisis management, trauma psychology, and cultural awareness (Pöchhacker, 2008: 30). Particularly during crises such as disasters, wars, pandemics, and mass migrations, the role of community interpreters extends beyond merely transferring messages from one language to another; it also encompasses vital responsibilities such as providing emotional support, ensuring timely access to accurate information, and facilitating cultural adaptation. Within this framework, community interpreting is not solely a linguistic activity but also an integral component of humanitarian aid processes (Doğan, 2015: 61).

Interpreting and Interpreter Training in Disaster Processes

One of the institutionalized examples of community interpreting in Türkiye is the *Disaster Guide Interpreting* (Afette Rehber Çevirmenlik – ARÇ) initiative, which represents a concrete, field-based reflection of this multidimensional approach. Following the 1999 Marmara Earthquake, the communication difficulties experienced particularly with foreign search and rescue teams prompted volunteer interpreters to take action. In this context, an initiative launched within the Department of Translation Studies at Istanbul University soon evolved into an organized structure and gained official status in 2001 through a protocol signed between the Istanbul Governorship and the Translation Association. In the following years, with the support of universities such as Hacettepe and Dokuz Eylül, ARÇ expanded into a broader network and enhanced its scope through regular training sessions, drills, and field practices, assuming a significant role in disaster response with its rapid intervention capacity (Kurultay & Bulut, 2012: 84).

ARÇ facilitates coordination between international relief teams and local authorities by providing both oral and written interpreting services during disasters and emergencies, thereby ensuring effective information flow. For instance, it played an active role in major disasters such as the 2011 Van Earthquake and the 6 February 2023 Kahramanmaraş-centered earthquakes. In addition, ARÇ has increased the number of its volunteers, participated in drills, and strengthened its rapid response capacity. This initiative clearly demonstrates the organizational dimension and impact of community interpreting in disaster contexts (afetterehbercevirmen.org).

AFAD Volunteers consist of individuals who come together without any expectation of material or moral gain and who contribute their knowledge, skills, experience, physical strength, and time to disaster and emergency-related activities before, during, and after disasters, solely with the aim of serving

society (Aydemir, 2021: 392). Disaster preparedness involves not only technical interventions but also the planning of communication processes. At this point, disaster awareness training plays a critical role. Evaluations of programs such as the "Disaster Awareness Training for Individuals and Families" developed by AFAD in Türkiye indicate that the existing curriculum is open to improvement in certain aspects (www.afad.gov.tr).

Interpreters who will serve in disaster environments need to receive specialized training not only in interpreting techniques but also in the physical and psychological conditions required by disaster settings. Providing such training within the scope of ARÇ ensures that interpreters are equipped not only with linguistic skills but also with competencies in disaster management (Duru Kahraman, 2022: 83).

Community interpreting is not merely an activity based on linguistic transfer; it is a multidimensional field of expertise encompassing cultural mediation, ethical responsibility, crisis management, and social support. The ARÇ initiative in Türkiye offers a successful example of how this field operates in practice. Especially during crises such as disasters and emergencies, the effectiveness of community interpreters can be decisive not only in terms of communication but also in relation to the right to life (Kurultay & Bulut, 2012: 81). Therefore, structuring interpreter training in a multidimensional manner and integrating it with disaster awareness is of vital importance.

Conclusion

Natural disasters are not only sources of physical destruction but also complex crises that profoundly disrupt social order, individual lives, and public services. In this context, disaster management is a multidimensional and multi-actor process that extends far beyond technical interventions alone. To ensure effective disaster response, communication—particularly linguistic communication in multilingual and multicultural environments—emerges as a fundamental component.

In disaster settings, the ability of international relief teams to communicate effectively with local populations is of critical importance for accelerating aid processes and enhancing their effectiveness. At this point, community interpreting not only overcomes language barriers but also reinforces the reliability and accuracy of communication by facilitating the transfer of cultural meaning.

The Disaster Guide Interpreting (Afette Rehber Çevirmenlik – ARÇ) initiative developed in Türkiye stands out as a significant example responding to this need. By filling linguistic gaps in disaster-affected areas, ARÇ establishes a meaningful and effective bridge between foreign relief teams and local communities. However, for this model to remain sustainable and functional, interpreters must be equipped with disaster awareness, supported through regular training programs, and structurally integrated into disaster planning processes.

Based on a review of the relevant literature, this study has highlighted the role of community interpreting in disaster management and demonstrated that removing linguistic and cultural barriers ensures not only logistical efficiency but also fairness and accessibility in humanitarian aid. For future disaster management strategies, it is recommended that greater emphasis be placed on linguistic communication, that community interpreting practices be expanded, and that multidisciplinary collaborations in this field be actively encouraged.

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Girls' Middle Schools in the Ottoman Empire at the End of the 19th Century: Establishment Processes, Curriculum, and Social Perception

Erhan Vatansever[1]

Abstract

Before the Tanzimat Decree, the Ottoman Empire's education system consisted of two parts: primary schools (sibyan) and madrasas (religious schools). During this period, known as the classical period, girls could attend elementary schools like boys; however, the same was not true for madrasas, which were higher education institutions. The modernization that began in the Ottoman Empire with the Tanzimat Decree proclaimed in 1839 necessitated the restructuring of social institutions; within this context, the education system also underwent radical changes. For example, the "Maarif-i Umûmiye Nizamnâmesi" issued in 1869 included provisions regarding the schooling of girls. The new educational institutions developed and established during this period are cornerstones of the efforts to modernize the state and society. However, although these efforts aimed at increasing girls' participation in education, it is observed that they largely focused on the male population for a long time, while the inclusion of girls in education was addressed slowly and in a limited manner.

The work of intellectuals who played a significant role in the promulgation of the Tanzimat Decree also paved the way for new approaches in the field of education. During this period, the state's education policy primarily focused on increasing the number of schools, but it also aimed to encourage women's participation in social life through education. In line with this objective, girls' secondary schools stand out as the first systematic and public secondary education institutions for women in the Ottoman education system.

Girls' middle schools can be considered not only pedagogical institutions but also ideological spaces reflecting the gender roles, perceptions of women, and educational ideals of the time. The establishment processes, curricula, teacher profiles, and curriculum structures of these schools allow us to trace the roles assigned to women's identities within Ottoman society. At the same time, the opening of these schools was met with resistance from some quarters; at the local level, the education of girls has occasionally been a subject of debate due to cultural and religious reasons.

This study aims to examine, in a multifaceted way, the establishment processes of girls' middle schools (rüştiye) in the late Ottoman Empire, the curriculum implemented, and the public perception of these institutions. Within this framework, the social implications of education policies will be analyzed by drawing upon both primary archival documents and the press and official yearbooks of the period. This study offers a historical perspective on the trajectory of women's education in the Ottoman Empire, while also aiming to provide a historical context for gender discussions within contemporary education systems.

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Keywords: C Girls' Secondary Schools, Education, History of Education, Girls' Education

Introduction

Education, a very difficult and complex subject, is too important for societies to ignore. The difficulty of education lies in the fact that it encompasses many issues, including legal, economic, moral, and technical aspects (Kodaman, 1980). Derived from the Latin words Educare (to nourish), Educario (to develop, to prepare the environment), and Edecere (to elevate, to raise) (Topses, 1982), education, which has a history as long as humanity itself, requires a solid system for a society to survive and develop. The education system in question needs to be renewed and modernized using scientific methods, taking into account national development goals, the nation's social and economic structure, the developmental levels of those being educated, and all its potential (Başaran,1994). In other words, education is determined by the social and economic structure, and even more so by the philosophical views and attitudes of the society in which an individual lives (Binbaşıoğlu, 1982).

Before the Tanzimat Decree, the Ottoman Empire's education system consisted of two parts: primary schools (sibyan) and madrasas (religious schools). During this period, known as the classical period, girls could attend elementary schools like boys; however, the same was not true for madrasas, which were higher education institutions. The modernization that began in the Ottoman Empire with the Tanzimat Decree proclaimed in 1839 necessitated the restructuring of social institutions; within this context, the education system also underwent radical changes. For example, the “Maarif-i Umûmiye Nizamnâmesi” issued in 1869 included provisions regarding the schooling of girls. The new educational institutions developed and established during this period are cornerstones of the efforts to modernize the state and society. However, although these efforts aimed at increasing girls' participation in education, it is observed that they largely focused on the male population for a long time, while the inclusion of girls in education was addressed slowly and in a limited manner.

The first examples of schools established by the state in our history date back to the second half of the 18th century with military schools. The establishment of state-run civilian schools took place in the mid-19th century. The modernization of the Turkish education system, which has a long history, began with the Tanzimat Decree, proclaimed in the mid-19th century. Although the decree issued in 1839 did not contain any clause regarding education, the intellectuals of the time accepted that the intended modernization was possible through modern education. Opened in 1848 under the name Dârülmuallimîn-i Rüşdî, this school, established to provide secondary education for male students, was the first modern school opened during that period. Ten years after the establishment of this school, the Cevrî Kalfa Girls' Secondary School was opened in Sultanahmet, Istanbul, for girls (Öztürk, 2008). Thanks to the opening of this school, girls, after attending the primary schools of the time (sibyan schools), also began to attend middle schools, which were the first stage of secondary education.

The Maarif-i Umûmiye Nizamnâmesi, proclaimed in 1869, are not only the first fundamental initiative in our history regarding education, but also the first significant law concerning the education of girls. The regulations prepared by the Commission for Mekatib-i Sıbyan-ı Müslime stipulated that both boys and girls should be sent to the primary schools, which constitute the first stage of education (Cicioğlu, 1985). The same regulation stipulates that if there are two primary schools in a neighborhood or village, one of them will be for girls, and girls will be required to attend this school between the ages of 7 and 11 (Kodaman, 1980). The same regulation also specified the subjects to be taught in the primary schools where girls would receive their education as follows (Somel, 2000);

Usûl-i Cedide	Yazu Talimi
Kurân-ı Kerim	Muhtasar Fenn-i Hesâb
Tecvîd	Muhtasar Târîh-i Osmânî
Ahlâka Müteallik Rasâil	Muhtasar Coğrafya
İlmihal	

Methods

This research is a historical study aiming to examine the establishment processes, curriculum structure, and social perception of girls' secondary schools from the year 1839, when the Tanzimat Decree was proclaimed, to the end of the 19th century. This study is structured within a qualitative research design and is based on historical research and archival document analysis methods.

This study is being conducted within the framework of qualitative research. Due to the nature of the subject, the focus has been on generating meaning through historical documents, narratives, official records, and written cultural products, rather than quantitative data.

This study involves thematic analysis of original documents from the period, based on documentary analysis and content analysis techniques.

Data Collection Process

a. Primary Sources (Archival Documents and Official Publications)

Prime Ministry Ottoman Archives (BOA)

Education Yearbooks (H. 1300–1326)

Student and teacher numbers, province-based school data, curriculum content.

Periodicals such as Tercümân-ı Hakîkat

Public debates on education and their societal implications.

b. Secondary Sources

Academic articles, master's and doctoral theses

Tables, graphs, and references presented in studies found in the literature.

Data Analysis Methodology

The obtained documents were analyzed using qualitative content analysis methodology. Documents were classified according to specific themes, and the following coding system was created. Since all documents were evaluated within the context of the period, the historical contextual analysis method was also used as a supporting tool. The research is limited to the period between 1839 and 1900. Based on the accessibility of the documents, the study has focused on all provinces of that period in general. In this way, the spread of girls' secondary schools, first opened in the capital Istanbul, throughout the country could be followed, albeit to a limited extent, and comparative analyses could be carried out.

Findings

Although the primary focus of the state's education policy following the Tanzimat Decree was to increase the number of schools, significant efforts were also made to enable girls to participate in social life through education. The first result of these efforts was the Cevri Kalfa Girls' Secondary School, which opened in Istanbul in 1859. After this school achieved the desired success, efforts were made to increase the number of such schools that girls could attend. As a result of these efforts, the number of schools increased to eight ten years after the establishment of the first girls' secondary school (Erdem, 2013). After these schools opened in the capital Istanbul and proved popular, similar schools quickly began to open in other regions of the country. The subjects taught in Inas Rüşdiye schools, which means girls' secondary school, are as follows (Maarif Salnamesi, 1316);

Kurân-ı Kerim ve Tecvîd	Ulûm-ı Diniyye
Kıraat	İmla
Kitabet	Kavâid-i Lisân-ı Osmânî
Arabi	Farsi
Hüsn-ü Hat	Ders-i Eşya ve Malumat-ı Nafia
İdare-i Bitiye	Ahlak
Hıfz-ı Sıhha	Hesap

Coğrafya Tarih

El Hünerleri

When examining the curriculum implemented in the girls' secondary schools mentioned above, it is evident that it takes into account the requirements of general basic education while also being structured with the principle of "preparation for women's duties". At the beginning of the 19th century, there were no secondary schools (rüşdiye) that girls could attend, but from the mid-19th century onwards, both the number of schools for girls increased and significant developments occurred in the curricula of these schools.

The suggestions of intellectuals and statesmen aiming for the modernization of society, as well as the proposals of local administrators who supported this idea, the approval of the Ministry of Education, and demands from the public, had a significant impact on the spread of girls' secondary schools outside of Istanbul. From the mid-19th century onwards, girls' secondary schools spread rapidly throughout the country. While they were established in separate buildings in large cities such as Istanbul, Edirne, Thessaloniki, and Izmir, those opened in smaller towns, often referred to as provinces, were generally opened as additional classes in the buildings of existing boys' secondary schools. Although the number of girls' secondary schools opened during this period was fewer than the number of boys' secondary schools, girls' secondary schools stand out as the first systematic and public secondary education institutions for women in our education system. The girls' secondary schools opened during this period are not only pedagogical institutions but also hold a significant place in the history of education because they served as ideological spaces reflecting the gender roles, perceptions of women, and educational ideals of the time.

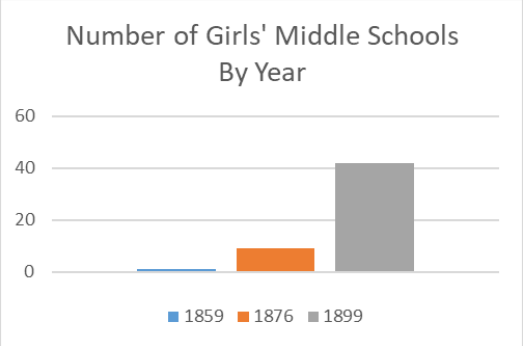
During the early years of Abdul Hamid II's reign, there were 9 girls' middle schools in the country, with 38 teachers and 309 students (Koçer, 1992). By the end of the 19th century, the number of girls' middle schools had risen to 42, the number of teachers to 203, and the number of students to 4262 (Maarif Salnamesi, 1316-1317).

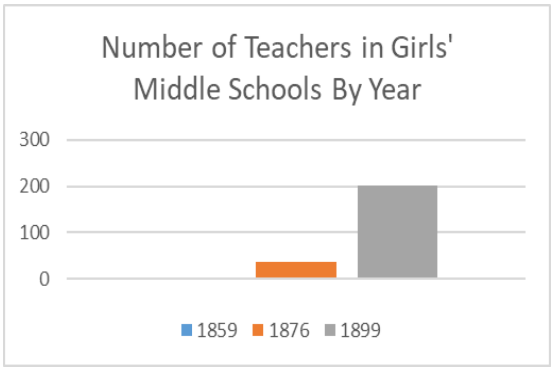
Table 1:
According to the Education Yearbooks, girls' middle schools between 1898-1899

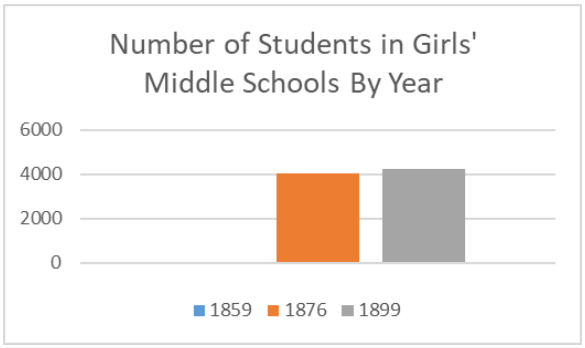
Okul Adı	1898		1899	
	Öğretmen Sayısı	Öğrenci Sayısı	Öğretmen Sayısı	Öğrenci Sayısı
Eyüp İnas Rüşdiyesi	6	170	6	176
Sultanahmet İnas Rüşdiyesi	8	245	8	316
Üsküdar İnas Rüşdiyesi	6	131	6	122
Fener Kale Rüşdiyesi	6	120	6	149
Beşiktaş Rüşdiyesi	8	213	7	199
Mirgün İnas Rüşdiyesi	7	81	7	112
Üsküdar Kız Sanayi Mektebi	19	152	20	150
Aksaray Nihari Kız Sanayi Mektebi	19	147	22	154
Cağaloğlu Leyli Kız Sanayi Mektebi	30	177	29	180
Hususi Küçükmustafapaşa İnas Rüşdiyesi	5	230	8	223
Hususi Atpazarı İnas Rüşdiyesi	7	214	7	208
Hususi ? İnas Rüşdiyesi	6	124	6	96
Edirne İnas Rüşdiyesi	4	93	5	100
Erzurum İnas Rüşdiyesi	-	-	2	120
Adana İnas Rüşdiyesi	3	137	1	35
Ankara İnas Rüşdiyesi	2	21	2	12
Denizli İnas Rüşdiyesi	2	66	2	80
İzmir İnas Rüşdiyesi	3	105	2	70
Manisa İnas Rüşdiyesi	-	-	3	120
Beyrut İnas Rüşdiyesi	2	176	3	176

Lazkiye İnas Rüşdiyesi	-	-	2	48
Akka İnas Rüşdiyesi	-	-	1	20
Halep İnas Rüşdiyesi	2	109	4	-
Bursa İnas Rüşdiyesi	4	121	3	118
Diyarbekir İnas Rüşdiyesi	4	122	4	163
Serez İnas Rüşdiyesi	1	23	1	25
Selanik İnas Rüşdiyesi	5	273	5	147
Selanik Mekteb-i Türki İnas Şubesi	5	-	-	-
Şam İnas Rüşdiyesi	4	134	4	135
Sivas İnas Rüşdiyesi	3	147	2	136
Canik İnas Rüşdiyesi	1	79	-	-
Trabzon İnas Rüşdiyesi	2	67	2	-
Kastamonu İnas Rüşdiyesi	5	57	5	62
Kosova Merkez Vilayet İnas Rüşdiyesi	2	130	1	132
Konya İnas Rüşdiyesi	1	-	1	?
Mamüratül-Aziz İnas Rüşdiyesi	1	35	2	68
Manastır Merkez Vilayet İnas Rüşdiyesi	4	46	4	46
Yanya İnas Rüşdiyesi	2	-	4	98
İzmit İnas Rüşdiyesi	2	95	1	99
Preveze İnas Rüşdiyesi	-	-	2	100
Musul Merkez Vilayet İnas Rüşdiyesi	-	-	1	20
Sinop İnas Rüşdiyesi	-	-	2	47
Toplam	**191**	**4040**	**203**	**4262**

Looking at the table above, it can be seen that after the first middle school (rüşdiye) was opened in Istanbul in 1859, allowing girls to continue their education after primary school, these types of schools quickly spread throughout the country. The opening of the Darülmuallimât school in Istanbul in 1870 (Öztürk, 1993), the first of which was established to train teachers for primary and middle schools for girls, played a very important role in the spread of girls' middle schools. Although middle schools for girls are spread throughout the country, there is a significant difference in the teaching staff between schools in Istanbul and those in rural areas. For example, Sultanahmet Girls' Middle School has eight teachers, while Canik Middle School has only one teacher. As a result of this situation, while there are approximately 30 students per teacher at Sultanahmet Girls' Middle School, there are 79 students per teacher at Canik Girls' Middle School. The differences between the curricula of the girls' middle schools, which were established in the second half of the 19th century and rapidly spread throughout the country, and the industrial schools, which were considered equivalent to middle schools at that time, are also noteworthy.







According to the education yearbooks of 1898 and 1899 published by the Ministry of Education, there was a significant increase in the number of girls' middle schools throughout the country by the end of the 19th century. While there were only 9 schools in the 1870s, this number increased by 366% to 42 within 30 years. Furthermore, the number of teachers in these schools increased by 434% from 38 to 203, and the number of students increased by 1279% from 309 to 4262. While these figures may not seem high by today's standards, they are quite significant considering that until the second half of this period, there were no middle schools that girls could attend.

Thanks to these schools, which opened in the mid-19th century and increased in number over time, the number of women in many professions that made up Ottoman society began to increase by the end of the century or the beginning of the 20th century. For example, the *Hanımlara Mahsus Gazete* (Ladies' Gazette), whose writing staff largely consisted of women writers such as Emine Semiye, Makbule Leman, Nigar Hanım, P. Fahriye, Rana bint-i Safvet, İsmet Hanım, and Münire from Soğanağa Neighborhood, who received their education in girls' middle schools, began publication in 1895.

At the beginning of the 19th century, girls receiving an education at school was not a widely discussed issue in society. During this period, educated women would teach girls and women in the neighborhoods how to read the Quran and impart other religious knowledge. This shows us that girls have been able to receive education, albeit superficially, since ancient times. Boys, after attending primary school, could go to madrasas and, from the 1773s onwards, to various military and civilian schools, where they could continue their higher education. Girls' education, however, had been neglected. Before 1859, they had no formal educational institution other than primary schools. During this period, although the education of girls in the West progressed much slower than that of boys, advancements in this area had begun 100-150 years earlier compared to the Ottomans.

The modernization that began in the Ottoman Empire with the Tanzimat Decree of 1839 fundamentally changed the perspective on the education of girls in society. One of the best ways to understand these changes in Ottoman society is to look at the novels and periodicals written during this period. In Takvim-i Vekâyi, the first official gazette published in our history, the following article was written regarding the education of girls (Koçer, 1992) :

"...Although the official schools that have been opened so far have been largely a privilege granted to boys, girls and boys who wish to receive an education should benefit from this opportunity without discrimination. Until now, only boys have benefited from this educational opportunity, while girls, despite all their desires and aspirations, have been deprived of it..."

The fact that Takvim-i Vakayi, the official state newspaper of that period, published an article supporting girls receiving education equal to boys is quite significant in terms of showing the state's perspective on the issue, the belief in society that girls should also be educated, and the expansion of schools for girls. Shortly after the article was published, the first official girls' middle school, Cevri Kalfa İnas Rüşdiyesi, was established.

In an article titled "The Education of Girls," written by Ahmet Mithat Efendi, a prominent intellectual and statesman of that era, and published in the Tercümân-ı Hakîkat newspaper, this societal change was expressed as follows (Tercümân-ı Hakîkat, 1294):

"Until very recently, it was believed that knowledge and skills were exclusive to men, and that it was bad if women and girls read, wrote, or became scholars and scribes. Is there any doubt about how wrong this belief is?

It was later understood that knowledge and skill were just as necessary for women as they were for men. It was even understood that women needed more education than men. Because women were considered not only the mothers of men but also their first teachers..."

Conclusion

Throughout our history, education has been one of the most important factors in the modernization of the state and society at every level. In the 19th century, many important changes were made in the field of education to prevent the Ottoman Empire and society from falling behind the West. Education was seen by the intellectuals of this period as the most important element in raising the kind of person who would rescue the state and society from this backwardness. In line with this idea, efforts to modernize education began with the Tanzimat reforms and continued during the Republican era. Looking at these efforts, it is seen that they initially began with the opening of new schools where modern education would be provided, and then focused on expanding these schools throughout the country. One of the educational issues emphasized during this period was ensuring that girls, like boys, could receive education in modern schools.

Twelve years after the opening of the first modern civilian middle school in our history, the boys' middle school, in 1847, the Cevri Kalfa School, the first girls' middle school in our history, was opened in Sultanahmet in 1859. By the end of the 19th century, girls' middle schools had spread throughout the country, reaching 42 in number. The ability of girls to continue their education in secondary schools was made possible thanks to the efforts of intellectuals, whose numbers increased during the Tanzimat period, the support given to these efforts by statesmen, and the demands of families. As the success of girls attending these schools has been recognized by society, demand for these schools has steadily increased. In this way, the awareness that women should receive education just like men began to be accepted in society during this period. By the end of the 19th century, there were 42 girls' middle schools, 203 teachers, and 4262 students throughout the country. Although these figures may seem small in quantity, they are quite significant considering that there were no secondary schools for girls until 1859.

Appendices



The Cevri Kalfa Girls' Middle School, which is now used as the Turkish Literature Foundation building.



Hanımlara Mahsus Gazete (Newspaper for Ladies)

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AI as a Tool to Enrich Drama Practices in Language Teaching: Instructional Design for A1-Level German Learners

Sema Nur Tunçyüz[1]

Abstract

This research has investigated the existence and quality of drama-based activities in the German language textbook Deutschgenie A1.1 currently in use by MEB, along with how AI generators may provide suggestions that could enrich and increase the variety of drama activities in beginner-level language education. By means of qualitative content analysis, the present study first identified and categorized the existing drama tasks in such forms as role play, improvisation, and short simulations while documenting their intended learning outcomes.

It subsequently asked the same set of AI models-e.g., ChatGPT, Claude-to generate alternative or more sophisticated drama-based activities suitable for A1-A2 learners, evaluating the output of the AI models for pedagogical depth, feasibility, creativity, and curricular alignment. The results showed that the textbook contains only a few drama activities, most of which were optional or did not include detailed instructions on how to carry them out. By contrast, AI-generated proposals widened the pedagogical perspectives.

Claude provided realistic, everyday scenarios involving travel, emergencies, and service encounters, and emphasized techniques such as "slow speech," strategic pauses, and increased focus on intelligibility to reduce learner anxiety. It also recommended the use of realia, including toy money or maps, and incorporated ethical considerations by encouraging the use of fictional identities during role plays. ChatGPT produced game-oriented and modular activities-such as the "Command Game" and "Auction Game"-that were closely connected to textbook learning outcomes and easily adaptable with simple classroom materials. It also emphasized active learner engagement and suggested matrix-style dialogues useful for vocabulary recycling and fluency-building.

Despite some stylistic variations, both models showed several similarities in the following aspects: they dealt with key A1 topics, such as greetings, daily routines, and shopping; they touched upon all four language skills; they promoted the development of interaction via some structured role play; and they allowed for supportive classroom practices. Asked to develop supermarket scenarios, the tool-generated activities proved comparable and pedagogically sound "Customer & Cashier" activities, which would include polite expressions, defined roles, and turn-taking sequences.

The findings of the study indicate that both AI systems provided high-quality drama suggestions aligned with the curriculum; Claude turned out to be very good at producing comprehensive, structured designs, while ChatGPT contributed dynamic, student-centered activities. Integrating AI-supported drama tasks into MEB-based German textbooks seems to provide a promising solution for current pedagogical deficits, personalization, and strengthening learners' communicative competence and confidence.

Keywords: AI in language education, communicative competence, drama-based teaching, instructional design, MEB German textbooks.

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Introduction

Language learning has gradually moved away from a grammar-based and rote memorization process to a student-centered approach that focuses on developing communicative competence. In this respect, drama-based teaching methods-Role Play, Simulation, and Improvisation-offer students an effective means to practice the language in a more realistic, stress-free, and meaningful environment. Drama bears great pedagogical value in its potential to reduce foreign language anxiety and enhance learner agency.

In Turkey, foreign language textbooks published by MEB constitute the basis of language education. The quality and content of those books directly influence the students' success in achieving target language proficiency. Deutschgenie A1.1 is a German textbook that covers basic language structures and daily communication topics for beginner-level students. However, to what extent these kinds of books reflect theoretically accepted communicative approaches constitutes a frequent debate in the literature (Sarkiler, 2025a). It is often observed that activities in such books can be superficial, lacking in sufficient detail, or presented as optional tasks. Recent studies on DaF textbooks in Turkey have underlined the need for the evaluation of these materials not only structurally but also in terms of readability and alignment with CEFR standards (Başaran, 2023; Başaran, 2026).

Recent rapid developments in AI technologies have opened new avenues for education. Applications such as ChatGPT and Claude, for instance, are remarkable in their complex text output generation and the creation of pedagogical scenarios. This indicates that AI can actually become not just a supportive tool but also a design partner that may yield creative and enriching content for teachers, hence transforming the value of language teaching.

The present study combines two key aspects: a) The assessment of the potential contribution of the existing drama activities in the MEB textbook to Communicative Competence, and b) An evaluation of the capacity of Artificial Intelligence tools to produce drama-based materials capable of filling the detected gaps and of raising students' engagement and confidence.

In this context, the study aims to answer the following research questions:

RQ 1: What is the current status of drama activities in the MEB Deutschgenie A1.1 textbook, and how can artificial intelligence tools contribute to enriching these materials?

RQ 1.1: Which drama activities (role play, simulation, improvisation, etc.) are included in the textbook?

RQ 1.2: How do ChatGPT and Claude models generate drama suggestions for A1-level German learners?

RQ 1.3: What are the similarities and differences between the two AI models in terms of pedagogical approach and design characteristics?

RQ 1.4: Which pedagogical gaps in the existing teaching materials can be addressed by AI-supported suggestions?

This analysis aims to provide a systemic perspective on integrating the communicative content of MEB German textbooks with modern pedagogical approaches and AI technology (Başaran, 2024a), offering significant implications for curriculum developers and language teachers.

Literature Review

The current literature review was prepared as a synthesis of three key points: the established benefits of drama-based pedagogy, persistent deficits in DaF textbooks, and emerging capabilities and risks of LLMs that establish the theoretical underpinning and rationale for this study.

Research strongly underlines that drama and performative approaches ought to be integrated into language teaching from a psycholinguistic and neurodidactic perspective. Various studies demonstrate that these elements actively provoke emotional, cognitive, and bodily learning processes and are thus linked to greater motivation and long-term memorization by learners (Bellezza, 2020; Calpe, 2020). Among the goals set in developing performative competence is at the core. From an empirical perspective, studies continue to reveal that drama-based formats clearly help develop critical non-

linguistic competencies in creativity, empathy, and self-confidence (Geneuss, 2020). Moreover, continued and authentic drama activities contribute significantly to fostering motivation and social competence (Isiguzel, 2020). Anxiety still acts as one of the major deterrents in FLL in Turkey, however (Yorulmaz & Arabacıoğlu, 2023). With regards to the German language departments of Turkey, many studies have focused on how high levels of anxiety among students call for pedagogical distinctiveness (Balkaya et al., 2020).

There still seems to be a serious gap in pedagogical practice in the narrower DaF context, especially concerning the practical implementation of drama-based methods. Although instruction officially switched to CLT, content analyses show that textbooks are still alarmingly grammatical-centric (Uysal & Yavuz, 2018; Arabacıoğlu & Balkaya, 2023). Works analyzing digital and printed material-such as "Netzwerk neu A1" or "Schritte"-indicate that cultural topics and exercises do exist, but the level of communicative and creative tasks often lacks depth (Arabacıoğlu & Yeğin, 2023). The term "drama" is therefore more likely to be reduced to pre-structured dialogues lacking the improvisational-pragmatic depth that communicative practice would require. This is further exacerbated by an examination system that strongly focuses on grammar and vocabulary.

The emergence of LLMs has a promising potential to bridge these textbook gaps. LLMs are seen to lighten the teacher workload by automatically generating materials, and personalized learning offers (Başaran, 2025b). However, the integration of LLMs brings along different risks that shift between admiration and anxiety among educators (Başaran, 2024a). These risks involve the possibility of hallucinations (Zhang, 2023; Lin, 2024) and also the fact that the emotional intelligence displayed is not actually genuine. Furthermore, while AI may be used in evaluation and grading situations, the "Human-in-the-Loop" approach is recommended as an optimal strategy. This view demands that educators take active control over the AI output and fine-tune it themselves.

Conclusively, the synthesis of these areas generates a new, yet largely under-researched, hybrid framework. This research tests AI's capability in enhancing restricted textbook content with pedagogically sound scenarios, meeting future-oriented perspectives within sustainable foreign language education (Sarkiler, 2025b).

Method

The qualitative content analysis method was employed in this study to address the research questions. Data sources included two main parts: the German textbook Deutschgenie A1.1, which was published by Turkey's Ministry of National Education; and outputs generated by two LLMs, namely ChatGPT-4o and Claude 3.5 Sonnet. These two AI models were selected based on their different architectures and training datasets, enabling a comparative exploration of both diversity and convergence in their responses-a methodological approach increasingly advocated in recent research related to educational technology.

Procedure and Data Analysis: Following the principles of systematic materials evaluation defined by Tomlinson (2011), the textbook and teacher's guide were scanned for drama-based activities; these activities were then categorized into types based on instructional labels. Learning outcomes from each of the eight units were used to prompt both AI models, requesting drama activities aligned with those outcomes. The prompting strategy followed the "role-playing" and "instructional design" frameworks suggested for effective educational AI interaction. The responses of the models were systematically gathered to ensure reproducibility.

AI outputs were evaluated through four pre-determined criteria adapted from communicative language teaching and drama pedagogy frameworks, including: (1) Pedagogical Depth-inclusion of anxiety management, realia, four skills integration, and reflection stages drawing on Schewe's (2013) concepts of holistic learning; (2) Feasibility-ease and cost-effectiveness of classroom implementation; (3) Creativity-encouragement of spontaneous, authentic language use based on Kao & O'Neill's (1998) improvisation standards; and (4) Curriculum Suitability-alignment with A1 grammar and vocabulary, evaluated against the Council of Europe's (2020) CEFR descriptors.

Findings

This section elaborates on the results of the content analysis, which systematically addresses the research questions.

Status of Drama Activities in the Textbook (RQ 1.1)

The textbook and teacher's guide were scanned systematically for the presence of any drama-based activities. The activity types, based on thematic labels used in instructions, were categorized into four categories: "Dialog/Sprechübung" (dialogue/speaking practice), "Ratespiel" (guessing game), "Kettenspiel" (chain game), and "Spielvorschlag" (game suggestion). Each single activity was analyzed for mode of presentation, that is, whether it was obligatory or optional, the extent of instructional detail supporting it - comprehensive or restricted - and if it addressed intended learning outcomes.

Response to Research Question 1.1 in connection with the drama-based activities of the textbook Deutschgenie A1.1 yielded several findings. First, only a few role-play and simulation activities were found in the textbook, whose main emphasis lies in reading comprehension, listening tasks, and structural drills. Second, the drama activities that are present in the textbook are largely framed as optional extensions, which may encourage or tempt teachers to omit them altogether. Lastly, the instructions given for these role-plays are often very brief, often amounting to no more than one or two sentences, such as "Spielen Sie die Dialoge in der Klasse vor." This is likely to yield superficial dialogues lacking creative or spontaneous language use; supportive elements such as character description, role cards, or challenging situational twists which might stimulate improvisation and deeper involvement in simulated communication are lacking.

Suggestions Obtained from AI Models (RQ 1.2) The outputs of the AI models were rich and diverse in pedagogical suggestions with high potential to fill the gaps in the textbook. Table 1 shows the characteristics of the two language models.

This study adopted a qualitative content analysis method (Krippendorff, 2018; Creswell, 2014) to address the research questions. The data sources consisted of two main components: the Deutschgenie A1.1 German textbook published by Turkey's Ministry of National Education and outputs generated by two Large Language Models (LLMs)—ChatGPT-4o and Claude 3.5 Sonnet. These AI models were selected because of their different architectures and training datasets, enabling a comparative exploration of both diversity and convergence in their responses, a methodological approach increasingly advocated in recent educational technology research (Kasneci et al., 2023; Başaran, 2024a).

Procedure and Data Analysis The textbook and teacher's guide were scanned for drama-based activities, which were categorized into types based on instructional labels, following the principles of systematic materials evaluation defined by Tomlinson (2011). Learning outcomes from each of the eight units were used to prompt both AI models, requesting drama activities aligned with those outcomes. The prompting strategy followed the "role-playing" and "instructional design" frameworks suggested for effective educational AI interaction (Mollick & Mollick, 2023). The models' responses were collected systematically to ensure reproducibility.

AI outputs were analysed through four pre-determined criteria adapted from communicative language teaching and drama pedagogy frameworks: (1) Pedagogical Depth (inclusion of anxiety management, realia, four skills integration, reflection stages), drawing on Schewe's (2013) concepts of holistic learning; (2) Feasibility (ease and cost-effectiveness of classroom implementation); (3) Creativity (encouragement of spontaneous, authentic language use), based on Kao and O'Neill's (1998) improvisation standards; and (4) Curriculum Suitability (alignment with A1-level grammar and vocabulary), evaluated against the Council of Europe's (2020) CEFR descriptors.

Table 1.
Comparative Analysis of AI Model Drama Suggestions by Criteria

Criterion	Claude (Structural/Anxiety-Focused)	Chatgpt (Dynamic/Game-Focused)
Pedagogical Focus	Intelligibility, Use of Realia, Anxiety Reduction	Fluency, Gamification, Repetition, and Active Participation
Suggested Type	Detailed Simulation, Realistic Scenarios	Game-Based Role Play, Modular Activities
Feasibility	High (but requires realia)	High (with structured cards)
Unique Contribution	Instructions for slow speech and strategic pausing.	Matrix dialogues and innovative games like the "Command Game."

Claude's Characteristic Outputs:

Claude presented a very unique approach, relying specifically on principles of applied linguistics and anxiety management. This model generated multiple more specific, realistic scenarios for everyday situations and those potentially stressful in nature, such as transportation, lodging, and emergencies.

He included in the instructions for the teacher to maintain a "slow speech tone" and to pause strategically during the role play with the aim of minimizing foreign language anxiety in students. This emphasis, therefore, places intelligibility over fluency, especially for low-level learners. Continuing with this anxiety-sensitive approach, the other often-controversial issue that Claude dealt with is assessment in drama. Here, the model gives clear evaluation criteria that will again reward participation rather than correct errors in order to create a safe environment for beginner learners to overcome their inhibitions.

The model required the use of props such as toy money, maps, and calendars to enhance the realism of the role-plays. Finally, Claude clearly confronted the potential ethical issue of personal information being shared within role plays as he instructed students to use an alias.

Characteristic Outputs from ChatGPT:

ChatGPT was distinctively dynamic and modular, with gamification as its most salient feature. The outputs were solidly based on the learning outcomes of the textbook, and they were quite adaptable. Most notably, the model proposed witty scenarios to break the monotony of predictable dialogues and re-engage student interest. This is attested to by fun-oriented and encouraging tasks such as the "Command Game" or the "Auction Game." These activities were easily adaptable and quickly implementable through structured lesson plans, tables, or cards. Also, ChatGPT focused on students taking active roles and gave examples of matrix dialogues to support the repetition of certain vocabulary.

Comparison and Convergence between Models RQ 1.3

The outputs from the two models were quite different in general pedagogical approach, but shared remarkable similarities in structure and content, notably a striking convergence in the supermarket scenario.

The collected AI outputs were analyzed based on four predetermined criteria to compare systematically the pedagogical approaches of their outputs. The Pedagogical Depth criterion considered how the outputs integrated anxiety management strategies, use of realia, integration of four language skills, and structured reflection stages. The Feasibility criterion appraised the ease and affordability of implementation of activities in a typical classroom setting. Creativity checked whether the activities afforded opportunities to elicit natural, spontaneous, and genuine language use through elements such as unexpected situational comedy instead of relying on repetitive or scripted dialogues. Curriculum Suitability analyzed the grammar structure and vocabulary that clearly fitted the A1 level.

Applying these criteria brought out different shades of how the models interpreted the source material. In terms of Curriculum Suitability, for example, both models independently identified the linguistic target as A-level without explicit prompting, but with varying degrees of precision. Claude maintained a very consistent alignment with the textbook authors' A1 classification from the very first unit of the book onward. By contrast, ChatGPT estimated a slightly wider A1-A2 range for the same content, falling short of the textbook's more specific A1.1 designation. Again, with respect to scope, Claude supplied activity suggestions that spanned every one of the specified learning outcomes, while ChatGPT missed a number of foundational outcomes implicit in the unit.

Despite these divergences, one common strength emerged to contribute to Pedagogical Depth: both models did more than tell the teacher what to do; they partially demonstrated what student verbal outputs might be. This effectively acts as scaffolding to support the teacher in imagining the trajectory of the drama activity and considering how learners might respond.

Table 2 demonstrates the variety of scenarios the models have suggested for the same simple and standard prompt.

Table 2.
Thematic Scenario Suggestions of AI Models According to the Units of Deutschgenie A1.1

Unit / Thematic Area	*Suggested Scenarios by CLAUDE*	*Suggested Scenarios by GPT*
Unit 1: Introductions, Greetings, Basic Numbers (1-20)	"Meeting at the Airport," "Meeting in the Cafeteria," "Doctor's Examination," "Hotel Check-in," "Party Invitation," "Number Game," "Pantomime and Guessing," "Shopping at the Market"	"Introduce Yourself to Me!", "Count and Shop" (Market Role Play), "Wo wohnst du?" (Where do you live? - Map Game), "Wer bin ich?" (Who am I? - Identity Card Game), "Zustimmung und Ablehnung" (Agreement and Rejection - Reaction Game).
Unit 2: School, Routines, Commands, Speaking Slowly	"Robot Teacher," "Story of the Old Grandmother," "Pondering Student" (Pauses in Speech Exercises), "New Student Orientation," "Morning Routine Show," "Recipe," "Missing Words Detective."	"Komm! Mach mit!" (Come! Join in! - Command Game), "Meine Schule" (My School - Classroom Theatre), "Was magst du?" (What do you like? - Emotion and Preference Game), "Das verlorene Arbeitsblatt" (The Lost Worksheet - Classroom Adventure), "Text-Lücken-Spiel" (Text Gap Game).
Unit 3: Large Numbers (20+), Detailed Introductions, Places/Locations	"Real Estate Office," "Car Showroom," "Banker and Customer," "Supermarket Cashier," "Job Interview," "Speed Dating," "City Guide," "Survey Expert," "Lost and Found Office," "Comparison Expert."	"Zahlen-Zirkus" (Number Circus - Number Announcement Game), "Reise durch die Stadt" (Trip Through the City - Location Introduction Skits), "Wer bist du?" (Who are you? - Introduction/Description), "SMS-Role Play," "Wer wohnt wo?" (Who lives where? - Address Guessing Game).
Unit 4: Time, Date, Daily Needs, Transportation	"Train Station," "Calling a Taxi," "Police Station," "Hotel Reservation," "Doctor's Appointment," "Pharmacy Visit," "SMS and E-Mail," "WhatsApp Group," "Lost Item."	"Was machst du um drei Uhr?" (What do you do at three o'clock? - Daily Routine), "Ich brauche..." (I need... - Shopping Role Play), "SMS-Theatre" (Short Message Play), "Der Tagesablauf" (The Daily Schedule - Moving Timeline), "Montag bis Sonntag" (Monday to Sunday - Calendar Role Play).

Unit 5: Shopping, Price, Quantity and Describing People	"Silent Cinema Technique," "Repetitive Dialogue Drama," "Shopping Scenarios," "Card Games and Role-Playing."	"Im Supermarkt" (In the Supermarket - Supermarket Role Play), "Wie viel kostet das?" (How much does that cost? - Auction Game), "Postkarte aus..." (Postcard from... - Place Introduction Theatre), "Information Marketplace" (Marktplatz der Informationen).
Unit 6: Invitations, Messaging and Time Planning	"Appointment Making Scenarios," "Time Machine Game," "Post Office/Cargo Service Drama," "Live Calendar Drama," "Invitation and Event Organization," "Message Chain Game."	"Die Geburtstageinladung" (The Birthday Invitation - Invitation Letter Theatre), "Was machst du wann?" (What do you do when? - Time Schedule), "Die Einladung ist da!" (The Invitation is Here! - Message Drama), "SMS-Theatre with Time."
Unit 7: Personal Plans, Intentions and Interview	"Career Dreams Game," "Time Capsule Game," "Job Interview Simulation," "Character's Diary," "Weekend Plans Scenarios," "20 Questions Game," "Silent Cinema + Speaking."	"Was willst du machen?" (What do you want to do? - Future Plans Game), "Mini-Interview," "Fiktive Personen erzählen" (Fictional Characters Narrate - Fictional Character Diary), "Was hast du vor?" (What are you planning? - Plan Sharing Game), "Interview Carousel" (Interview-Karussell).
Unit 8: Shopping, Daily Objects, Environment	"Grocery Store-Market Chain," "Shopping at the Market," "Introduction of Household Items," "Street Signs and Directions," "Daily Life Theatre," "Live Dictionary," "Lost and Found Office."	"Im Supermarkt" (In the Supermarket), "Was kostet das?" (How much does that cost? - Label Game), "Schilder und Notizen" (Signs and Notes - Writing and Reading Drama), "Einkaufsliste" (Shopping List - Stage the List), "Mein Lieblingsladen" (My Favorite Store - Store Introduction).

Even though these suggestions show a wide range of variety, there are common cases to compare the approaches, for example, convergence in the supermarket shopping scenario:

The solutions developed for the supermarket shopping scenario, aligned with A1-level objectives, such as "understanding simple expressions to satisfy simple everyday needs," were remarkably similar and educationally robust. They used a common role set that defined the interactions "Customer"-"Cashier," and prescribed the use of standard polite expressions such as "Guten Tag!", "Ich brauche.", and "Was kostet das?". At a systemic level of lesson planning, they provided for phases of warm-up, list writing, role assignment, enactment, and reflection, and also suggested the creation of a supermarket atmosphere to offer authentic support. The convergence here showed that LLMs of different architecture can, when focused on the same pedagogic objective, provide solutions that converge with the systematic approaches of traditional instructional design. More importantly, both models proved their creative potential in suggesting examples of spur-of-the-moment simulation and situational comedy to improve student engagement. In general, the output was of good quality and easily refinable to a pedagogically valid state.

Discussion, Conclusion, and Suggestions

The findings of this study raise important discussion points with respect to the transformative role of AI in language education material design. The responses to RQ 1 verified that the drama-based materials in the MEB textbook were both quantitatively and qualitatively insufficient. In the context of RQ 1.4, the potential for AI-supported suggestions to fill in the pedagogical gap was clear.

Distinguishing Pedagogical Approaches of AI Models (RQ 1.3) The outputs presented by ChatGPT and Claude demonstrated that AI is truly capable of providing various and distinguishable pedagogically rich solutions. An anxiety-focused design by Claude reflects an approach closer to applied linguistics. This is in line with the findings that have signaled the necessity for specific strategies to overcome foreign language anxiety within the Turkish context as proposed by Balkaya et al. in 2020. ChatGPT's focus on gamification is proof that AI can design flexible lesson structures.

Convergence in the Systemic Design of AI The dramatic convergence in the supermarket shopping scenario would suggest that AI systems gladly internalize more traditional principles of instructional design. This naturally aligns with recent work suggesting that AI is reconstituting the "cultural dance of words" and the structural value of language teaching (Başaran, 2025a).

Filling Pedagogical Gaps by Means of AI-Supported Solutions (RQ 1.4) The ideas proposed by AI models fill some of the key gaps detected in the textbook. Firstly, AI enhanced pedagogical richness very significantly. Pedagogical richness is generally limited in DaF textbooks, as can be seen from the recent literature (Sarkiler, 2025a). Secondly, the anxiety management ideas put forward by Claude dealt with a key issue which is usually ignored. Lastly, AI offered dynamism, whereas textbooks are static. This is the point at which AI should be treated as an overall system that can enhance the pedagogical aspects of the teacher (Başaran, 2025b).

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Data Availability Statement: The data generated and analysed during the current study, consisting of content analysis codes and output from AI models, is available from the corresponding author upon reasonable request.

Conflict of Interest: The author declares that there is no conflict of interest regarding the publication of this paper.

Generative Artificial Intelligence Statement: The author used generative artificial intelligence (AI) tools (ChatGPT and Claude) for the purpose of generating potential instructional material suggestions (drama scenarios and lesson plan structures) which constitute the core data source for the comparative analysis in this study. The generated content was analysed and evaluated by the authors. Thus, multiple LLMs were used to improve, proofread, and translate the writing during the preparation of this study. The author takes full responsibility for the accuracy and integrity of the content analysis and the interpretation of the AI-generated material.

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15-17 OCTOBER 16th INTERNATIONAL BALKAN EDUCATION AND SCIENCE CONGRESS EDİRNE

Environmental Education in Greek Teacher Training: A Comparative Curricular Analysis of Primary Education Departments

Eleftheria Tsiouri[1], Charilaos Tsihouridis[2] & Konstantinos T. Kotsis[3]

Abstract

This study examines the inclusion of Environmental Education (EE) in the undergraduate curricula of nine Departments of Primary Education (DPEDs) of Greek universities for the 2024–2025 academic year. Through a meticulous examination of official study guides and actual course offerings, the research identifies significant discrepancies between the intended and implemented curriculum, indicating an inconsistency in the management of EE at the institution. The study categorizes courses based on teaching style, disciplinary concentration, curricular status, and semester allocation. The findings indicate that EE is fundamentally overlooked, with the majority of courses categorized as electives rather than integral components of the curriculum. The majority of the course content is theoretical, with only a limited number of applied, experimental, or interdisciplinary teaching approaches. The significant variability in the scheduling and locations of EE courses each semester indicates a lack of organization and a clear vision for the curriculum within the program. The study indicates that experiential education (EE) is not uniformly distributed throughout diverse primary education departments (DPEDs), resulting in an unequal accumulation of experience for future primary school educators. The research indicates that the pedagogical approach to Environmental Education in Greek teacher training programs inadequately prepares graduates to address environmental and sustainability challenges in educational settings. It necessitates a strategic reorientation of EE as an essential, pedagogically robust, and institutionally endorsed component of beginning teacher preparation.

Keywords: Environmental Education, Teacher Education, Curriculum Analysis, Primary Education, Greek Universities.

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Introduction

As environmental and sustainability concerns have intensified in recent years, Environmental Education (EE) has gained more significance within global school curriculum. These issues encompass not only environmental dimensions but also social, ethical, and educational aspects. This indicates that educators must prepare to cultivate environmentally conscious, critically engaged, and proactive citizens from an early age, aligning with the overarching objectives of primary science curricula to enhance inquiry, relevance, and conceptual comprehension (Harlen, 2013). This modification aligns with the broader movement in Environmental Education throughout the 1990s, emphasizing sustainability, involvement, multidisciplinary collaboration, and critical reflection, as elucidated by Tilbury (1995). This instructional responsibility begins with assisting young pupils in establishing a significant connection with their natural and social environments, which is essential to basic education (Shahriddinovna, 2023). Development should commence at an early stage. Consequently, early teacher education serves as a crucial platform for cultivating the knowledge, attitudes, and pedagogical strategies essential for future educators to address these intricate and interdisciplinary demands. This is particularly accurate as numerous preservice teachers perceive science as a "border crossing" into a distinct disciplinary culture (Mulholland & Wallace, 2002). Sterling (2001) contends that his vision of sustainable education necessitates not only curriculum enhancement but also a reorientation of the rationale and methodologies of learning. Researchers have determined that teachers' environmental identity and their connection to nature are strong predictors of their awareness of environmental issues and their willingness to support sustainability education in Greece (Gkargkavouzi, Paraskevopoulos, & Matsiori, 2018). This entails providing pupils with not only environmental information but also the capacity to engage in informed, democratic, and reflective actions, along with the action competence framework for sustainability education (Mogensen & Schnack, 2010).

The national education policy and curriculum reform initiatives of Greece have formally acknowledged environmental and ecological concerns. This parallels worries throughout Europe over the diminishing interest in science education and the necessity for systemic curricular innovation to re-engage students and educators (Osborne & Dillon, 2008). Revisions to educational curricula and teacher training protocols have consistently emphasized the necessity of integrating Environmental Education across all topics and educational tiers. Nonetheless, the implementation of these policy objectives in actual classroom settings, particularly within teacher training institutes and universities, remains inconsistent and under researched. This is attributable to significant systemic issues with the development and execution of EE in Greece (Papadimitriou, 2020). Previous research indicated that pedagogical students exhibited ambivalence towards EE, implying the existence of entrenched cultural and institutional barriers within Greek teacher education for decades (Kyridis et al., 2005).

The majority of individuals aspiring to become primary school teachers in Greece will complete undergraduate programs at the nine Departments of Primary Education (DPEDs) inside Greek institutions. The form and content of these programs are crucial for assessing the preparedness of new teachers to address environmental challenges in the classroom. Despite the significance of this role, there is a paucity of structured information regarding the representation, prioritization, and utilization of EE inside these systems. It is unclear whether Environmental Education constitutes an integral component of the curriculum or if it remains relegated to optional, peripheral, or inconsistent courses. This issue is particularly significant as recent studies indicate that Greek pre-service teachers exhibit markedly diverse levels of environmental literacy across cognitive, affective, and behavioral aspects. This indicates that the current EE provision has yielded varying outcomes on several categories of educators (Goulgouti, Plakitsi, & Stylos, 2019).

This study addresses deficiencies by conducting a systematic, comparative analysis of the academic curricula of all nine DPEDs in Greece for the 2024–2025 academic year. The study examines both the official study guides and the delivered courses to assess their alignment with the intended curricula. The analysis aims to address several interconnected questions, one of which is: What is the extent of EE instruction in higher education? What are the pedagogical and epistemological dimensions of the courses? Are these classes mandatory or elective, and how do they integrate into the undergraduate curriculum schedule? Do departments maintain a consistent and long-term strategy for environmental

education, or do environmental topics arise sporadically without leveraging prior knowledge or concentrating on instruction?

The study aims to ascertain the quantity and types of EE courses, as well as the conceptualization and implementation of EE within teacher preparation programs. The study posits that the methodology of Environmental Education in schools is not a neutral or technical matter; instead, it reflects the institution's priorities, the hierarchy of courses, and the underlying teaching philosophies.

The research situates Environmental Education within the broader framework of undergraduate teacher education in Greece. This provides evidence-based insights into the adequacy of prospective primary teachers' preparation for addressing educational aspects of environmental and sustainability challenges. The objective is to assist institutions in self-assessment, national curriculum development, and policy formulation in teacher education, aiming to enhance the visibility, coherence, and efficacy of EE across all educational tiers.

Research and Analytical Framework

This study examines the incorporation of Environmental Education (EE) within the undergraduate curricula of the nine Departments of Primary Education (DPEDs) of Greek universities for the 2024–2025 academic year. The study employs a systematic content analysis technique to examine both the official study guides constituting the formal curriculum and the actual classes provided. This enables academics to critically examine both the intended and implemented courses.

The primary objective was dual: firstly, to ascertain the quantity of EE-related courses within each curriculum; and secondly, to examine the pedagogical approaches employed in these courses, consistent with recent research emphasizing the necessity for systematic institutional support and explicit methodologies in fostering science-related literacy in teacher education (Chernyshova & Brodovskaya, 2022). The study examined the alignment between the curriculum design and its instructional delivery to identify potential discrepancies in structure, administration, or pedagogy.

To accomplish this, we examined each EE-related course from many perspectives:

1. Types of Course Objectives: There are five categories of courses: general education/foundational, subject-specific, skill-development, pedagogically focused, and hybrid. This classification facilitated the identification of the epistemic orientation of each course by distinguishing between content-centered education, methodologically driven training, and the didactic transfer of scientific information. Combined methodologies that integrate scientific reasoning with literacy skills have been shown to enhance conceptual understanding and communication proficiency in elementary education (Liston & Hennessy, 2018). The fundamental concept is that the courses provided reflect the institution's priorities in equipping educators to impart environmental literacy. These aims must be grounded in educational frameworks that regard sustainability education as beyond just factual instruction; they should also cultivate students' abilities and motivation to actively and responsibly influence society. This is a fundamental concept in the action competence framework (Mogensen & Schnack, 2010). International research supports this perspective, indicating that pre-service teachers develop greater awareness of environmental issues and enhanced preparedness for teaching when engaged in hands-on, reflective, and contextually relevant sustainability activities (Birdsall, 2022).

2. Curricular Positioning: The second component examined the formal placement of EE courses within the program framework. This involved examining whether they were mandatory, mandatory electives, normal electives, or voluntarily selected. This analytical axis illustrates the significance of EE to the institution. When programs categorize EE as an elective, they may inadvertently imply that it is not a crucial component of the fundamental abilities required by future primary school educators.

3. An additional important aspect of the analysis was the distribution of each course over the semesters. This temporal mapping elucidated the sequence in which each department prioritized the instruction of environmental education. For instance, scheduling EE courses early may signify their fundamental role in a teacher's identity, whereas scheduling them later may indicate they serve as a capstone or specialized function. There was significant disparity among departments in this aspect.

4. Quantitative and Instructor-related Indicators: The quantity of EE-related courses offered by each department was documented, together with information regarding the instructors of such courses. Particular emphasis was placed on the instructors' areas of specialization and their research contributions to environmental education. These data points provide insight into the academic and research cultures of each DPED. They illustrate the capabilities and limitations of each institution in facilitating teachers' understanding of environmental issues.

This intricate analytical approach provides a robust perspective on the present state of Environmental Education within Greek teacher training. This facilitates a substantive discussion regarding the coherence of the curriculum, the equilibrium among disciplines, the efficacy of lesson planning by educators, and the school's dedication to imparting knowledge on sustainability to students.

The study provides a comprehensive framework for evaluating Environmental Education (EE) courses; nevertheless, it inadequately elucidates the practical use of this paradigm. The research design inadequately elucidates several critical components, including the selection of appropriate courses, the coding of educational typologies, and the measures implemented to ensure inter-rater agreement on evaluations. The study lacks sufficient procedural detail, rendering it irreproducible and difficult to assess. The study would gain credibility and scientific rigor by providing a clearer explanation of the content analysis procedure, the criteria employed for data classification, and the validation methods utilized, such as peer review or departmental feedback.

Findings and Interpretative Analysis

The comparative analysis of the data reveals a number of critical patterns and inconsistencies that speak to broader structural and pedagogical issues within the Greek Departments of Primary Education (DPEDs) regarding Environmental Education (EE).

Curricular Inconsistencies: Intended vs. Implemented Curriculum.

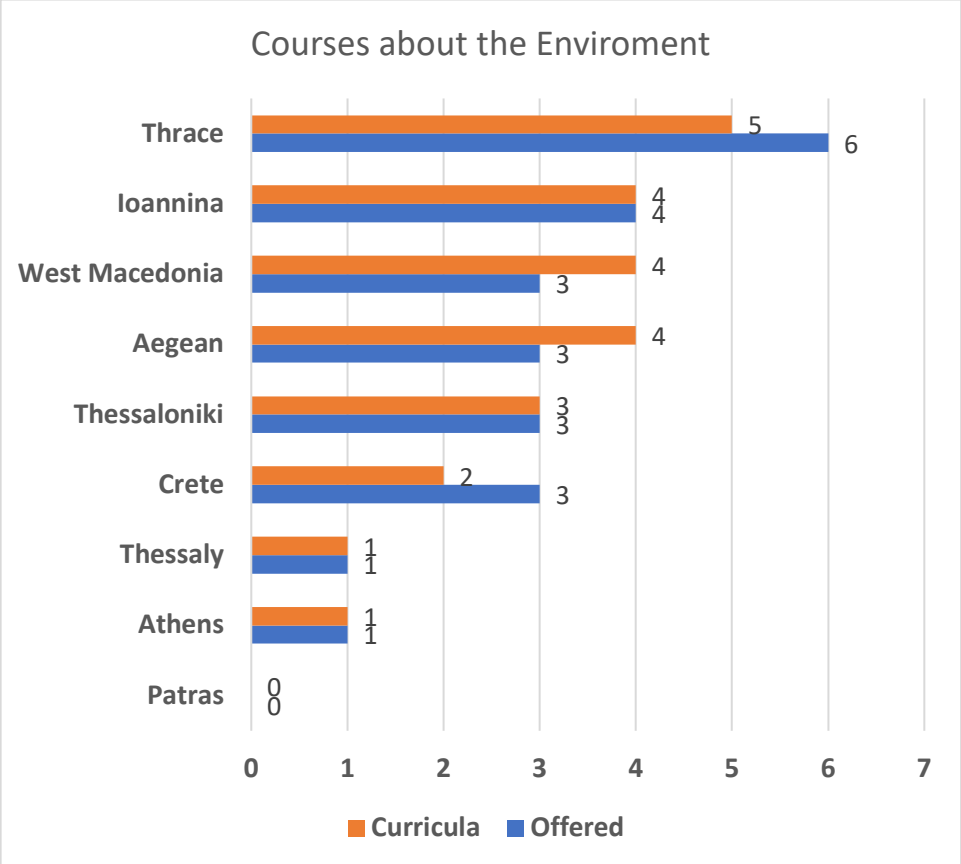


Figure 1. *Discrepancy between Planned and Implemented EE Courses across DPEDs*

Figure 1 depicts the variances between the intended and executed Environmental Education (EE) courses across the nine Departments of Primary Education (DPEDs) in Greece for the academic year 2024–2025. Each department displays two bars: one indicating the number of EE-related courses formally cataloged in the curriculum guides (planned curriculum), and the other representing the courses that were actually implemented (enacted curriculum).

The figure indicates a systematic implementation deficit across multiple departments, where the quantity of EE courses delivered is insufficient compared to those scheduled. In certain instances, this deficiency is negligible, whereas in others it is significant—signifying a disparity between curricular design and institutional capabilities or priorities. Potential reasons for this disparity may encompass inadequate staffing, diminished enrollment in elective EE courses, logistical limitations, or administrative choices that deprioritize EE offerings in practice.

This visual depiction highlights a fundamental conclusion of the study: the formal incorporation of EE in curriculum papers does not consistently result in uniform educational practice. The disparity between intended and implemented curricula weakens the integrity and legitimacy of teacher education programs and raises questions regarding the institutional accountability of DPEDs in meeting their educational commitments to sustainability and environmental literacy.

Figure 1 elucidates the fragility of EE integration in Greek teacher education by exposing this gap, underscoring the necessity for structural mechanisms to guarantee the actual delivery of planned EE content. This underscores the study's overarching critique of curricular fragmentation and advocates for systemic reforms that reconcile curricular aims with implementation realities.

An especially notable instance of curricular deficiency is the University of Patras Department of Primary Education, which provides no courses in Environmental Education (EE), neither as mandatory nor as elective offerings. This omission is substantial considering the department's function in training future educators and the national dedication to incorporating sustainability into education. The absence of any EE provision not only signifies a wasted opportunity to connect with national and international educational agendas but also illustrates the institutional fragmentation and inconsistent priority of EE observed throughout the DPED landscape. This raises essential inquiries regarding the expectations for preservice teachers at this institution to acquire the information and pedagogical skills required to tackle environmental and sustainability issues in the primary classroom.

Pedagogical Orientation and Epistemological Depth

Figure 2 illustrates the pedagogical orientation of Environmental Education (EE) courses among the nine Greek Departments of Primary Education (DPEDs), categorized into three principal types: theoretical/lecture-based, applied/practicum-focused, and experimental or field-based offerings. The graphic, depicted as a stacked-bar chart for each department, clearly illustrates the preeminence of theory-intensive courses, which represent the most substantial portion in almost every DPED. In numerous departments, theoretical courses comprise more than fifty percent of the EE curriculum, suggesting that conceptual instruction predominates over practical or inquiry-based learning experiences.

In contrast, applied courses—focusing on curriculum design, pedagogical techniques, or classroom execution—constitute a far smaller percentage, whilst experimental or field-based courses are exceedingly rare, frequently appearing only intermittently or being entirely absent in specific departments. This biased distribution indicates that preservice teachers have restricted access to experiential methods that promote investigation, place-based learning, or outdoor environmental inquiry, all of which are considered crucial for developing environmental action competence and scientific literacy.

The cross-departmental comparison highlights considerable variability: some DPEDs include limited practical and experimental courses, suggesting localized attempts to integrate theory with practice, while others depend predominantly on lecture-based methodologies. These differences reflect the wider curricular fragmentation noted in the study and underscore a persistent epistemological imbalance in

Greek teacher education, favoring content transmission over participative, multidisciplinary, and skills-based pedagogies. Thus, Figure 2 reinforces the assertion that systematic reforms are essential to integrate more practical, inquiry-based, and collaborative experiential education throughout the teacher-preparation continuum.

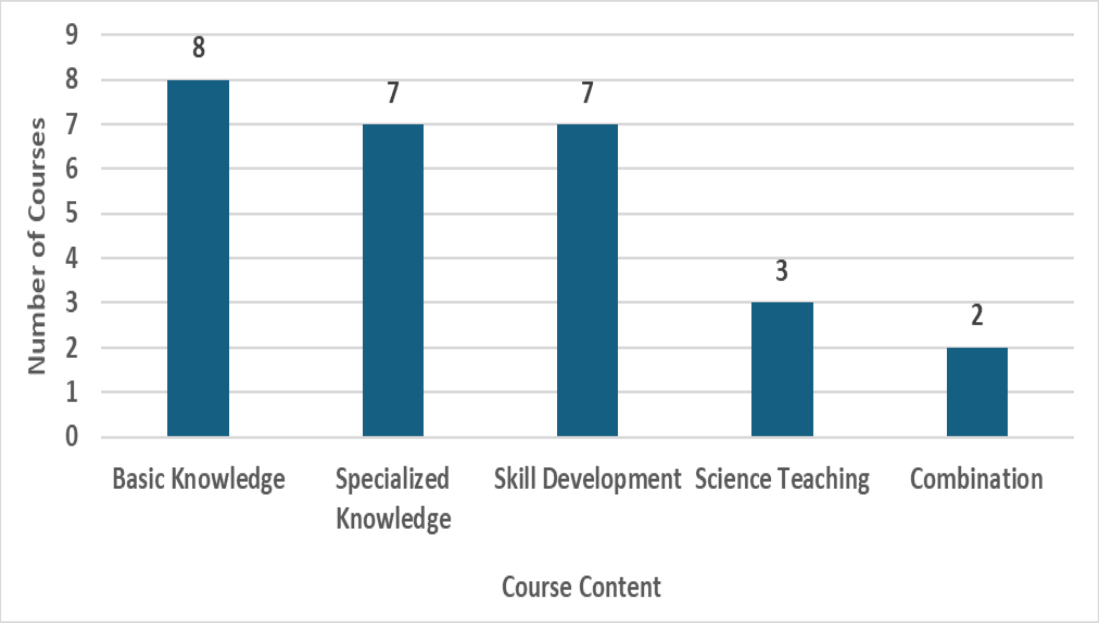


Figure 2. *Classification of EE Course Content by Pedagogical Orientation*

Institutional Commitment as Reflected in Course Type

Figure 3 illustrates a comparative review of the curricular state of Environmental Education (EE) courses provided by the nine Departments of Primary Education (DPEDs) in Greece. Courses are classified into four distinct categories according to their formal placement within the curriculum: compulsory, compulsory electives (organized elective modules), standard electives, and free electives (unstructured, freely selected options).

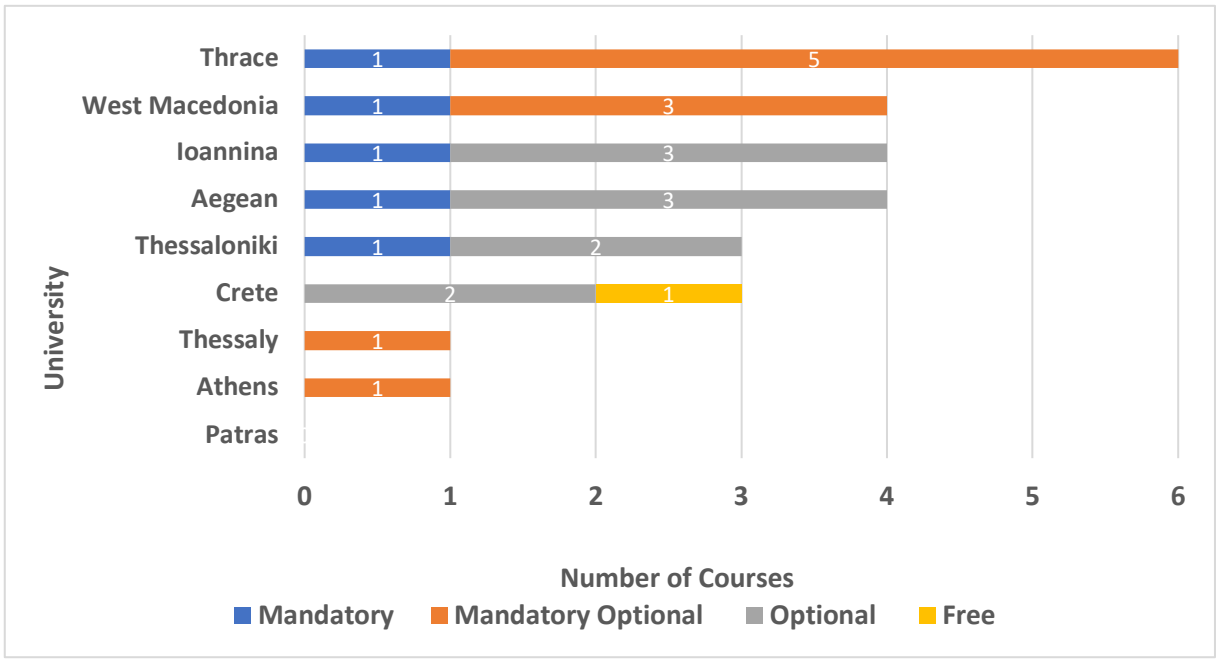


Figure 3. *Curricular Status of EE Courses across Departments*

The findings indicate a pronounced prevalence of elective courses, with a substantial quantity of EE courses classified as standard or free electives. This pattern indicates that EE is predominantly seen as non-essential in the majority of undergraduate programs, positioned at the margins of teacher education. A limited minority of departments mandates EE as a mandatory element, reflecting a constrained institutional dedication to ensure that all preservice teachers interact substantively with sustainable curriculum.

The peripheral positioning of EE within optional areas carries significant educational and policy ramifications. It renders participation with environmental issues dependent on student interest or scheduling flexibility, rather than on a collective understanding of environmental education as an essential professional competency. This structural marginalization hinders the possibility of uniform, comprehensive preparation in environmental literacy and contradicts international recommendations—such as those outlined in UNESCO's (2021) roadmap—that advocate for the integration of sustainability education in all teacher training programs.

The figure therefore illustrates not only quantitative disparities in course status but also highlights the broader institutional undervaluing of EE across Greek teacher education programs. It underscores the need for national-level policy interventions and curriculum reforms that would reposition EE as a compulsory, cross-cutting domain in the formation of future primary educators.

Temporal Integration and Programmatic Coherence

Figure 4 illustrates the temporal allocation of Environmental Education (EE) courses during the eight academic semesters of undergraduate study in the nine Greek Departments of Primary Education (DPEDs). The visualization, shown as a line graph or segmented bar chart, delineates the scheduling of EE courses over the four-year program, highlighting significant discrepancies in sequencing and curricular integration among schools.

The findings demonstrate that several departments provide EE courses early in the program (e.g., Semesters 1–3), indicating a desire to integrate environmental consciousness into the basic training of prospective educators. Conversely, numerous other departments postpone EE instruction until the concluding semesters (e.g., Semesters 7–8), frequently without any preceding or subsequent coursework. Some exhibit an irregular or random distribution, with EE courses occurring in isolated semesters and lacking developmental continuity.

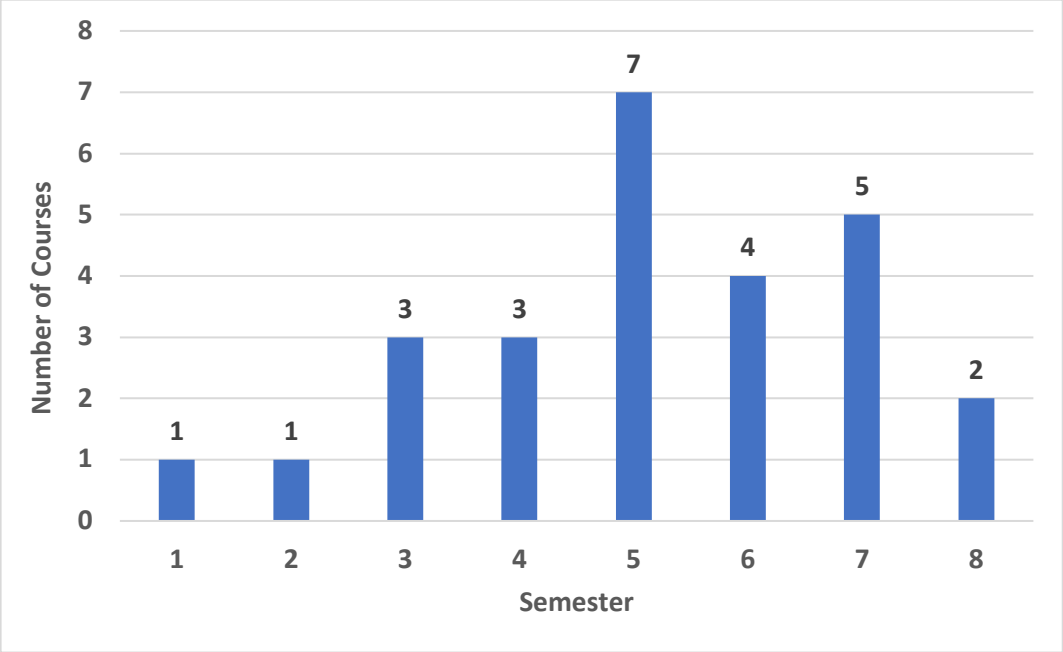


Figure 4. *Semester Allocation of EE Courses in DPED Curricula*

This chronological dispersion indicates a lack of a unified pedagogical vision for the function of EE in teacher education. In a developmental curriculum, early and ongoing exposure to EE would facilitate a structured advancement in knowledge, skills, and pedagogical reflection. The identified anomalies threaten to compromise the development of cohesive environmental literacy among preservice teachers. When EE is limited to the last semesters, it may be regarded as supplementary enrichment rather than a fundamental component of educational identity development.

The figure highlights the necessity for a nationally coordinated curriculum design that guarantees uniform and carefully sequenced EE training across the teacher preparation program. In the absence of such alignment, prospective educators may graduate with deficiencies in their environmental competency, hindering their capacity to effectively integrate sustainability ideas into their future classrooms.

Discussion

The examination of Environmental Education (EE) within the nine Greek Departments of Primary Education (DPEDs) reveals numerous issues regarding its structure and pedagogy. The results indicate deficiencies in the curriculum design and the educational priorities shaping the professional identity of prospective primary school teachers.

The significant disparity between the quantity of EE courses listed in official curriculum guides and the actual number of EE courses offered across departments is not merely a procedural issue. It indicates a disparity in structure between formal planning and actual execution. This mismatch may indicate more extensive issues within the institution, such as insufficient personnel with the requisite abilities, a lack of student interest in electives beyond conventional courses, or inadequate autonomy for departments to strategize and make decisions. The structure of the Greek educational system exacerbates these issues. Rigid administrative regulations and centralized curricular oversight have been demonstrated to impede the integration of sustainability education (Kougias & Efstathopoulos, 2020). The structural and systemic issues encountered by teachers in Greek secondary schools mirror those reported by others, including insufficient training, inadequate institutional support, and a lack of time for implementing environmental education programs (Ntona et al., 2023). Indeed, these issues resemble previous findings: Greek educational students generally exhibit unclear or utilitarian attitudes toward environmental education due to insufficient exposure in academic settings and a lack of institutional emphasis on the subject (Kyridis et al., 2005). Such conflicts reveal underlying issues between the objectives of experiential education and the regulations of formal educational institutions, which occasionally constrain transformative or critical pedagogical approaches (Stevenson, 2007). Brazil faces analogous issues, since primary school educators assert that the Natural Sciences curricular frameworks frequently do not align with classroom requirements or their pedagogical methods (Paz & Locatelli, 2023). This discrepancy undermines the curriculum's reliability as a policy and instructional tool, regardless of its origin. Papadimitriou (2020) stated that a longstanding disparity exists between governmental proclamations regarding education and its actual implementation in Greece. It prompts us to consider the extent to which proclaimed institutional commitments to sustainability education are genuinely implemented.

The organization of the course content indicates that the majority of EE-related courses predominantly emphasize theoretical principles, with infrequent incorporation of experimental, field-based, or practical pedagogical approaches. This tendency indicates a pedagogical reductionism in the teaching of EE, since it is predominantly perceived as a body of information rather than a transformational, practice-oriented learning domain. This contradicts the principles of experiential learning, which assert that profound conceptual development must stem from active involvement (Kolb, 1984). This restricted emphasis is incompatible with the inherently interdisciplinary and action-oriented nature of environmental concerns. When environmental education is perceived as an abstract or solely cognitive discipline, opportunities for cultivating critical thinking, systems thinking, and active engagement in tangible environmental issues diminish. The Action Competence approach sees EE as a tool to give students the power to take charge of fixing environmental challenges (Jensen & Schnack, 1997). This contradicts that notion.

The paper extensively examines the structural and pedagogical dimensions of Environmental Education (EE), although it addresses the issue of multidisciplinary integration only in a cursory manner. This

constitutes a crucial aspect of contemporary environmental education and scientific literacy. An examination of how EE integrates with other disciplines, particularly the natural sciences, social sciences, and emerging transdisciplinary fields such as STEM and climate education, would be highly beneficial. Interdisciplinary approaches not only illustrate the complexity of environmental issues but also assist educators in employing more comprehensive and contextually grounded methodologies. The study misses the chance to determine if Greek teacher education programs foster the systemic thinking essential for cultivating action-oriented, critically literate educators by failing to investigate the presence of cross-curricular connections. Adding this point of view would put the study more in line with global educational ambitions and improve its criticism of how fragmented the curriculum is.

The examination of course type reveals a secondary degree of marginalization. The majority of EE courses are categorized as electives, either within optional modules or as subjects selected independently by students. The limited number of mandated EE courses indicates that environmental literacy is not integrated into the foundational curriculum for teacher education. This aligns with findings from other nations, highlighting both structural issues and obstacles identified by instructors, including insufficient support from the school, inadequate time, and an excessive curriculum (Parry & Metzger, 2023). The perspectives of teachers align with the broader curricular changes identified in this study, indicating that systemic, cross-level reforms are increasingly essential. According to UNESCO's (2021) ESD Roadmap, sustainability education must be comprehensively incorporated into formal teacher training frameworks. This structural marginalization contradicts the global objective. Instead, it remains an optional or supplementary subject that students may readily overlook. This diminishes the likelihood that future educators will impart environmental knowledge in alignment with sustainability principles, resulting in disparities in the instruction of these principles in schools after graduates commence their careers.

The chronological arrangement of EE courses indicates that departments do not consistently provide environmental subjects in the same sequence across the degree program. In the absence of a coordinated paradigm, several departments instruct Electrical Engineering in the initial semesters as foundational knowledge, whereas others defer its instruction to later years as an advanced or specialized subject. This inequitable allocation hinders individuals from enhancing their environmental knowledge and pedagogical abilities. For example, early introduction followed by continued involvement could aid with the gradual absorption and teaching of EE subject. Conversely, tardy or isolated presentations may lack depth in concepts and preparedness for instruction.

The study omits the perspectives of preservice teachers, who would be most impacted by the presence or absence of Environmental Education (EE) in teacher training programs. It is challenging to thoroughly assess the implemented curriculum or the efficacy of current methodologies without understanding how students perceive, engage with, or derive benefits from the offered EE courses. Student feedback may elucidate the extent to which environmental education influences their pedagogical approach, ecological awareness, and preparedness to instruct on sustainability. Comparable outcomes have been observed among currently employed instructors in Greece. In that context, environmental identity has been associated with attitudes towards the implementation of environmental education, highlighting the necessity of educating teachers on cognitive, emotional, and identity-related matters (Gkargkavouzi et al., 2018). Incorporating these perspectives would not only enhance the empirical foundation of the study but also help bridge the disparity between the intended curriculum and students' actual experiences in school. This would provide a firmer basis for making changes to the curriculum and the school system.

The cumulative impact of these findings is that institutions are increasingly becoming fractured. The specific department in which a student is enrolled significantly influences the extent and quality of the beneficial and complete experiential education they can receive. This dispersion indicates a more significant issue: an absence of a coherent vision for the curriculum. Fien (1993) characterizes this as the inability to recognize Environmental Education as a catalyst for social transformation rather than merely a conduit for knowledge transmission. Certain departments offer a greater number of courses, enhanced integration, and more explicit guidance on instructional methods. Conversely, some provide only little or peripheral exposure, resulting in significant disparities in environmental training for teachers across. The absence of standardization complicates the establishment of a cohesive culture of

environmental education and hinders the alignment of teacher training with broader educational objectives pertaining to sustainability, citizenship, and transdisciplinary competence. The inconsistencies diminish the likelihood that teacher education programs will facilitate transformative learning experiences for future educators, which are essential for critically evaluating assumptions, altering perspectives, and developing a professional identity centered on sustainability (Mezirow, 1997).

Conclusion

This study examined the integration and pedagogical approaches of Environmental Education (EE) into the undergraduate curricula of nine Greek Departments of Primary Education (DPEDs) for the academic year 2024–2025. The research provided empirical examples of the organization, timing, and pedagogical approaches of EE in teacher training programs by contrasting the approved curriculum materials with the actual courses delivered.

The analysis revealed a significant disparity between the proposed study plans and the actual academic offers. This discrepancy indicates that the formal inclusion of EE in curriculum papers does not guarantee its implementation. This misalignment may indicate systemic issues, such as insufficient academic personnel or limited program frameworks, or it may reflect institutional decisions regarding priorities that render EE less consistent and trustworthy. More broadly, it raises concerns regarding the efficacy of curriculum development procedures and the extent of institutional support for environmental themes beyond mere rhetoric. Stevenson (2007) discusses the structural tensions between the transformative objectives of Environmental Education and the conservative, segmented framework of schooling. These are the identical challenges that Sterling (2001) advocated for a transition to sustainable education. In Greece, it is evident that policy rhetoric frequently fails to result in systematic curricular reform (Papadimitriou, 2020). This type of misalignment may result in systemic issues that hinder EE's consistency and reliability. These issues may encompass insufficient academic staff, inflexible program structures, or decisions on institutional priorities.

The pedagogical analysis indicates a predominance of academic EE courses over practical ones, implying that environmental education is not being conceptualized comprehensively. The absence of integration of experimental, field-based, or applied pedagogical methods indicates a preference for learning over participation or experiential engagement. This contrasts with research indicating that pre-service teachers develop more significant and assured teaching identities through experiential, place-based, and reflective learning methods (Birdsall, 2022). These pedagogical approaches not only enhance students' comprehension of concepts but also foster their commitment to sustainability by engaging them and rendering the courses pertinent to their lives. These areas remain underdeveloped in the majority of Greek DPED curricula. Consequently, numerous departments jeopardize the establishment of a disjointed and passive perspective on the environment, undermining the objective of cultivating educators who are proactive, analytical, and committed to sustainability. Models employing scientific reading and project-based learning have demonstrated significant potential in fostering creative thinking and engagement in science instruction among preservice teachers (Suryandari, Rokhmaniyah, & Wahyudi, 2021). The scarcity of courses incorporating design thinking, inquiry, or local environmental contexts hinders students' ability to connect their learning to real-world societal and environmental issues.

Another significant discovery is that EE is systematically marginalized within the curriculum. The majority of EE courses are offered as electives, allowing students to select them at their discretion or combine them with unrelated fields of study. This renders them far less prominent and impactful in the curriculum. The elective classification indicates that EE training relies on student motivation and departmental flexibility, rather than reflecting a comprehensive institutional commitment to environmental literacy. The availability of courses at varying times likely contributes to the disparate development of environmental literacy abilities across students. This has already been observed in studies involving Greek pre-service teachers (Goulgouti et al., 2019). Consequently, graduates from diverse disciplines may exhibit significant disparities in their exposure to and interest in environmental subjects. This complicates the establishment of a comprehensive and universally applicable framework for environmental education in Greek elementary schools.

The study revealed that the distribution of EE courses among departments during the semester was markedly uneven over time. Some institutions introduce environmental subjects early in the curriculum, whilst others defer this instruction until later semesters, often lacking clear structure or consistency. This mismatch complicates the establishment of a steady, developmentally suitable learning trajectory that could facilitate students' understanding of environmental concepts and pedagogical abilities throughout the program. The absence of a uniform timeline indicates a lack of a unified pedagogical vision on the role of EE in teacher education.

The results indicate a broader inconsistency in the instruction of Environmental Education within Greek teacher preparation programs. This fragmentation manifests in more than merely disparate access to courses and educational attainment. It is also evident in the absence of systematic alignment, uniform curricula, and intentional pedagogy. The result indicates that the degree of environmental literacy among prospective educators is more influenced by randomness than by the structural organization of schools.

To effectuate a significant impact on Greece's and the global objectives for sustainable development and environmental stewardship, teacher education must realign its emphasis. Environmental education must transition from the periphery of the curriculum to the core of teacher preparation. EE should be integrated into many components of the undergraduate curriculum, mandated, employ interdisciplinary approaches, engage students, and assist academic staff in becoming proficient in environmental education.

This study asserts that Environmental Education should be prioritized within the framework of teacher education in a systematic and thorough manner. Future educators can acquire the requisite information, attitudes, abilities, and pedagogical tools to instruct the next generation on sustainability only through a coherent, well-structured integration of Environmental Education that is diverse in instructional methodologies.

To enhance the study's practical applicability, it would be advantageous to provide more precise and actionable policy recommendations for both national and institutional contexts. Implementing EE as a mandatory component of initial teacher education programs, establishing a national framework to standardize and facilitate EE integration across all DPEDs, and ensuring that qualified educators deliver EE content by providing staffing and professional development guidelines. The study identified differences and fragmentation, thus proposing that collaboration among departments or the harmonization of national curricula could address these issues. By explicitly delineating these particular strategies, the study could enhance initiatives to formulate policies and implement modifications within institutions that would integrate sustainability education as a fundamental component of teacher training.

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Inclusive Education Experiences Of School Guidence Counselor

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Abstract

It is becoming increasingly common for children with special needs to be included in the formal education system through mainstreaming/integration practices. In this context, studies focusing on factors that may facilitate or hinder efforts to include children with special needs are noteworthy. While existing studies often emphasize the importance of teachers' attitudes in inclusion, they reveal the necessity of additional services such as supporting students and teachers in creating positive attitudes, informing other students in the class and parents. School counselors, due to their job descriptions, are the people who play the most role in identifying and solving the problems of all students in schools. This study aims to describe the observations and experiences of guidance counselors regarding inclusion practices, with the idea that their experiences with special needs/inclusion students will be important and guiding. The study was conducted with the phenomenological pattern, one of the qualitative research methods. The participants of the study were determined by the criterion sampling method and consisted of 14 guidance counselors working in different schools in the central district of Edirne in 2024-2025. Data were collected through semi-structured interviews. Teachers were asked 10 questions in accordance with the purpose of the research. The findings indicate that school counselors; It reveals that they mostly observe social and academic problems with their inclusive students, and that classroom teachers often approach them with complaints about students' behavioral problems, reporting, and Individual Education Program preparation. Regarding the parents, the guidance counselors stated that the parents of the mainstreamed students were mostly conscious and constructive, some of them were tired and uncooperative, and that the parents of other students in the class showed a negative approach when the mainstreamed student had behavioral problems

Keywords: Inclusive Education, Guidance counselor, Student with special needs, Teacher experiences.

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Introduction

The educational processes of individuals with special needs, defined as individuals who have different needs from their peers in terms of physical, mental, emotional, and social characteristics (Kargın, 2004, p.1), are also differentiating. In the past,special education, which generally took place in separate schools, is being replaced by inclusion education practices. The education of individuals with special needs together with their peers in formal education institutions can be seen as an important step toward their full and independent participation in social life. According to the Special Education Services Regulation (2018), inclusion is defined as, education provided to individuals with special education needs to ensure they interact with other individuals at every type and level and realize their educational goals at the highest level, by offering support education services either full-time with their peers or part-time in special education classes. One of the most important factors for the success of inclusion practices is that all stakeholders—who have a direct or indirect impact on the education of individuals with special needs—maintain a positive and constructive attitude (Sarı, 2003). Classroom teachers, school administrators, counselors, classmates of the inclusion student, and families affect the inclusion process with their positive/negative approaches.

Identifying the views of teachers who have a direct impact on inclusive education practices constitutes an important starting point for understanding the process, determining needs, and making effective plans. Taking into account the experiences of teachers who have worked with students with special needs and providing support in line with their views contribute to the development of positive attitudes toward inclusion and to the strengthening of collaboration. In Türkiye, numerous studies in the literature have examined the views of teachers from different subject areas and school administrators regarding inclusive education practices. Some of these studies include research on preschool teachers' views and suggestions regarding inclusive education (Gök & Dilek, 2011; Kocaoğlu, Acartürk, İskenderoğlu, & Çelenk, 2023), studies focusing on social studies teachers' views on inclusive practices (Demirezen & Akhan, 2016), research examining primary school teachers from different subject areas with respect to individualized education programs, legal regulations, and inclusive practices (Yılmaz & Batu, 2016), and studies investigating physical education teachers' views on inclusive education practices (Tuna, 2025).

School counselors play an important role in the inclusion of students with special needs because they provide support to other branch teachers in the process as inclusion practices increase in schools (Taller-Azulay, Heiman, & Olenik-Shemesh 2022). Counselors need to take a more active role in the Individual Education Program (IEP) process, from identification to implementation, and provide equal services to more students with special needs in regular education environments (Dunn & Baker, 2002; Owens et al., 2011). Furthermore, they are the first contacts in a wide range of areas such as supporting the academic/social adaptation of the inclusion student, monitoring the behaviors and attitudes of other students, providing consultancy to teachers, parents, and other students, and producing solutions for behavior problems.

Various studies that draw on the views of school counselors to evaluate different dimensions of inclusive education are available in the literature. In addition to studies that examine school counselors' perspectives on teacher behaviors toward students in inclusive classrooms (Demirbilek & Levent, 2020), the functioning of the Individualized Education Program (IEP) unit (Yazıcıoğlu, 2019), inclusive practices in primary schools (Özengi, 2009), and inclusive practices in preschool classrooms (Koçyiğit, 2015), the literature also includes studies focusing on school counselors' own experiences. These studies address topics such as the role of educational counselors in inclusivity and integration processes (Taller-Azulay, Heiman, & Olenik-Shemesh, 2022), the challenges faced by school counselors in inclusive education (Baran-Karalar, Bogenç, & Kargın, 2024), the evaluation of school counselors' competencies for inclusive education (Mažgon, Jeznik, & Ermenc, 2018), and the identification of inclusion-related needs (Akalın, 2014).

Due to their roles and the services they provide, school counselors conduct interviews and observations involving students in inclusive education, their peers in the classroom, teachers, and parents in response to every issue or situation brought to them. Therefore, identifying their experiences and views regarding all stakeholders involved in inclusive education practices constitutes the aim of the present study.

Method

In this study, phenomenology, one of the qualitative research methods, was employed. Phenomenology is a qualitative research approach that focuses on examining individuals' experiences and emphasizes the personal and subjective aspects of those experiences. In the present study, the experiences of school counselors regarding inclusive education were explored. In phenomenological research, it is essential that all participants included in the sample have experienced the phenomenon under investigation or have had contact with individuals who have experienced this phenomenon (Rolfe, 2006; Yıldırım & Şimşek, 2011).

Study Group

The study group consists of 14 school counselors working in different schools in the central district of Edirne province during the spring semester of the 2024–2025 academic year. The participants were selected using criterion sampling, and the criterion was defined as having worked as a school counselor for at least two years in a school with students receiving inclusive education. Table 1 presents the demographic characteristics of the participants.

Table 1.

Characteristic of Participants

ID	Gender	Age	Experience (Year)	School Degree	School Type
01	F	29	6	Middle School	Public
02	F	29	2	Primary School	Private
03	M	27	2	Middle School	Public
04	F	26	4	Middle School	Public
05	F	42	20	Middle School	Public
06	F	33	10	Primary School	Public
07	F	40	15	Primary School	Public
08	F	48	23	Primary School	Public
09	F	34	11	Middle School	Public
010	M	50	27	Primary School	Public
011	F	37	15	High School	Public
012	M	59	31	Middle School	Public
013	M	60	38	Primary School	Public
014	F	37	15	High School	Public

Data Collection Process

The data were collected through interviews using a semi-structured interview form developed by the researchers. Prior to the interviews, informed consent was obtained from the participants to ensure voluntary participation. Participants were also informed that the interviews would be audio-recorded using a voice recorder and that their real names would be kept confidential, and their consent was obtained accordingly.

The semi-structured interview form, which was finalized in line with expert opinions, consisted of eight open-ended questions addressing school counselors' personal information and their experiences related to inclusive students in their schools. The audio recordings obtained from the interviews were transcribed verbatim without making any modifications.

The questions directed to the school counselors were as follows:

1. a) How many inclusive students are there in total at your school?
   b) What are the numbers of inclusive students at your school according to their diagnoses?
2. In your opinion, do inclusive students experience any problems at school? If so, what are they?
3. Are there any problems reported to you by teachers working with inclusive students? If so, what are they?
4. Do you have any observations or experiences regarding the behaviors/attitudes of classmates toward inclusive students? If so, what are they?
5. Do you have any observations or experiences regarding the parents of inclusive students? If so, what are they?
6. Do you have any observations or experiences regarding the parents of other students in the classroom? If so, what are they?
7. As a school counselor, which diagnostic groups related to inclusive/students with special needs do you find most challenging to work with?
8. As a school counselor, what are the situations or problems you experience most difficulty with regarding inclusive/students with special needs?

Data Analysis

In this study, which was conducted using the phenomenological research method, interviews were carried out to examine the experiences of school guidance counselors. In the analysis of the questions included in the semi-structured interview form used during the interviews, both descriptive analysis and content analysis approaches were employed. According to the descriptive analysis approach, the collected data are summarized and interpreted based on predetermined themes. Content analysis, on the other hand, requires an in-depth examination of the collected data and focuses on uncovering meaning in the texts and analyzing their communicative content (Yıldırım & Şimşek, 2011; Toker, 2022).

Based on the questions posed to the guidance counselors, seven themes were generated in the study. These themes were: (1) problems experienced by students in inclusive education, (2) teachers' problems related to inclusive education, (3) classmates' attitudes, (4) approaches of parents of students in inclusive education, (5) approaches of parents of other students in the classroom, (6) challenging diagnostic groups, and (7) challenging situations. Under each theme, codes were developed from the participants' responses obtained during the interviews.

To enhance the transparency and trustworthiness of data analysis, all four criteria proposed by Guba and Lincoln (1982, as cited in Başkale, 2016)—credibility, dependability, confirmability, and transferability—were fully addressed in the study. Expert opinions were consulted again during the data analysis process. Two faculty members with doctoral degrees and expertise in qualitative research in special education were presented with examples of the generated themes, categories, and codes, and revisions were made in line with their recommendations.

Findings

In the research, the themes and codes developed based on the responses provided by the school counselors are presented in tables along with their frequencies (f). Directly below the tables, direct quotes from the participants' views have been included, with the participant's code written next to them

Table 2.

Number and Diagnosis of Inclusive Student

Participant	Number of	Diagnoses of Inclusive Students

	Inclusive Students	
P1	120	Mostly SLD, ADHD, Mild Autism, Mild ID
P2	2	1 Autism, 1 Developmental delay
P3	13	SLD, Language and speech disorder
P4	5	5 SLD (one also has a language and speech disorder)
P5	16	11 ID, 2 SLD + ADHD, 2 Hearing impaired, 1 Physical disability
P6	23	12 Gifted/Talented, 4 Mild autism, 3 Language and speech disorder, 2 SLD, 2 Physical disability, 1 ADHD
P7	23	12 Gifted/Talented, 4 Mild Autism, 3 Language and Speech Disorder, 2 SLD, 2 Physical Disability, 1 ADHD
P8	9	Majority SLD + ADHD, Speech disorder, 1 Gifted/Talented
P9	21	11 SLD, 8 Gifted/Talented, 2 Language and speech disorder
P10	23	Majority SLD, 2 Mild ID, 2 Physical disability, 1 Autism, 1 Language and speech disorder
P11	6	3 ADHD, 1 Visually impaired, 1 Mild autism, 1 Chronic illness
P12	8	6 SLD, 1 ADHD, 1 Hearing Impairment
P13		20 Majority SLD and ADHD,3 Mild autism, 2 mild mental retardation
P14	6	3 ADHD, 1 Visually impaired, 1 Mild autism, 1 Chronic illness

SLD: Specific Learning Disability ADHD: Attention Deficit Hyperactivity Disorder ID: Intellectual Disability / Mentally Disabled

Table 3.

School Counselors' Views on the Problems of Inclusion Students

Theme	Codes	f
Problem of The inclusive student	Social anxiety, social adaptation issues	6
	Academic problems	5
	Acceptance if there are no behavior problems	4
	Peer rejection/loneliness	3
	Situations varying by disability type	3
	Bullying	2
	Teacher rejection	2
	Friendship with other inclusion students	2
	No problems	2

As shown in Table 3, school counselors' views regarding the problems experienced by students in inclusive education vary. Social anxiety/social adjustment (n = 6) and academic difficulties (n = 5) were the most frequently reported problems. Some counselors stated that students with disabilities are accepted if they do not exhibit behavioral problems (n = 4), experience loneliness due to peer rejection (n = 3), and that the

situation varies depending on the type of disability (n = 3). A smaller number of counselors reported that students in inclusive education are exposed to bullying (n = 2), teacher rejection (n = 2), and that they tend to form friendships with other students in inclusive education within the school (n = 2).

"Compared to other students, these students have fewer friends, and they usually manage to find other students like themselves from different classes and become friends with them. We can observe this very clearly at school." (P7)

"The first problem students in inclusive education experience at school is the acceptance process by the school administration and teachers. Since our school administration is very aware and understanding in this regard, they provide strong support to both parents and students." (P3)

"The problems vary depending on the inclusive education group. Especially students with mild disabilities display a high number of attention-seeking behaviors in the classroom because they fall behind their peers academically." (P14)

Table 4.

Problems Reported by Teachers Working with Inclusive Students to School Counselors

Theme	Codes	f
Problems Related to Inclusive Education Reported by Teachers	Inability to keep up with the curriculum / lack of time	7
	Objection to the report / considering the student unsuitable for the class	4
	Requesting inclusion only in certain subjects	2
	No problems	3

The problems conveyed to school counselors by classroom and subject teachers working with inclusion students are presented in Table 4. Half of the counselors (n=7) stated that teachers approached them with the issue of being unable to complete the curriculum or being unable to allocate extra time for the inclusion student. Four counselors each reported observing that some teachers objected to inclusion reports, did not consider the student suitable for the classroom, and struggled with the inclusion student's behavioral problems[3]. There are also counselors who reported that some teachers requested inclusion to be implemented only in certain lessons (n=2) and some who reported that teachers did not convey any problems (n=3).

"*In this respect, for example, we have only one student diagnosed with a special learning disability, but our teachers think it is something more advanced. They only made a request regarding this student; other than that, we are not experiencing any trouble." P4*

"Teachers say they experience difficulties in implementation during the preparation of the IEP[7]. They say, 'Our lesson time is limited to 40 minutes, and I don't have time to devote one-on-one time to that child.'" P6

"Problems regarding poor adaptation with friends, not doing the assigned lessons, classroom adaptation, and peer relationships are frequently reported. These are the most common complaints." P13

Table 5.

Guidance Counselors' Views on Classmates' Attitudes Toward Inclusive Students

Theme	Codes	f
	Perception of difference / labeling	4

Theme	Codes	f
	Bullying	3
Classmates' Attitudes	Treating the student as a scapegoat	3
	Curiosity	2
	Social exclusion	2
	Reaction to different exams/support	2
	Perception of inability	2
	Acceptance/exclusion based on type of disability	2

The views of school counselors regarding the attitudes of classmates toward students in inclusive education are presented in Table 5. A wide range of responses from the counselors draws attention to the diversity of these attitudes. Four counselors stated that classmates perceive inclusive students as different and tend to label them. In addition to situations in which peers engage in bullying (n = 3) or scapegoat inclusive students (n = 3), counselors also reported the presence of students who are curious and ask questions about them (n = 2), exclude them (n = 2), react negatively to different examinations or additional support provided to inclusive students (n = 2), and express that inclusive students are unable to perform certain tasks (n = 2). Furthermore, some counselors indicated that classmates' acceptance or rejection varies depending on the type of disability (n = 2).

"*Classmates definitely think that the inclusive student is different from them. There is clearly such a perception." (P5)*

"They exclude them from the group. For example, when they need to form a group or coordinate—such as creating a volleyball team or organizing another activity or competition—they do not want to include them, saying things like 'you will hold us back' or 'you will slow us down.'" (P7)

"In this regard, our students also differ. We have students who have very positive peer relationships; however, students who are weak in areas such as communication and eye contact usually spend time alone or engage in very brief interactions." (P12)

Table 6.
Approaches of Parents of Inclusive Education Students According to School Counselors

Theme	Codes	f
	Parents experiencing anxiety/concern	5
Approaches of Parents of	Parents who are constructive/cooperative	5
Inclusive Education Students	Some parents are aware, some are indifferent	3
	Parents with whom cooperation cannot be established	2
	Indifferent parents who attend only when necessary	1

Table 6 presents the approaches of parents of inclusive education students according to the views of school counselors. The two most frequently expressed approaches were that parents were anxious/concerned (n = 5) and that they were constructive and open to collaboration (n = 5). Three counselors stated that while some parents of inclusive education students were knowledgeable and involved, others were indifferent. A small number of counselors also reported that they were unable to collaborate with parents (n = 2) and that some parents were indifferent and attended meetings only when they were obliged to do so (n = 1).

"They come because they care about peer relationships. They ask whether their children can receive support education at school. There were also parents who made an effort. Or when we invite them due to a behavioral problem, they do come." (P1)

"They have observations from their close environment and family. Naturally, they are suspicious—thinking that their child shows certain characteristics. Some then proceed with information. There is also one who does not have much knowledge about this issue, but is very interested in not missing any opportunity regarding the child's education." (P8)

"Parents probably come feeling discouraged because they encounter prejudice everywhere. However, after meeting our school administration and us, they become somewhat more relieved." (P14)

Table 7.
Parents' Attitudes of Other Students in the Classroom Toward the Inclusive Student According to School Counselors

Theme	Codes	f
Parents' Attitudes of Other Students in the classroom	Behavioral problems	7
	Not wanting the inclusive student in the classroom	4
	Some parents are constructive/positive	4
	Questioning why the student is in their child's classroom	3
	Negative influence on their own children / on each other	3
	Understanding / no problems	2

According to the views of school counselors, the approaches of parents of other students in the classroom toward inclusive education practices and inclusive students are presented in Table 7. Half of the counselors (n = 7) stated that when inclusive students display behavioral problems, parents of other students do not want these students in the classroom. The counselors reported that some parents adopt a constructive and positive approach (n = 4), some question why the inclusive student is placed in their child's class (n = 3), and some negatively influence their own children and other parents by talking about the inclusive student (n = 3). Two school counselors indicated that parents are understanding and that no significant problems are experienced.

"We had parents who asked, 'Why is this student in our class?' even though their child had no problems at all, no negative experiences in the classroom, and despite the fact that there was no harmful or problematic situation." (P2)

"When parents of other students speak negatively about that student, especially if the student has behavioral problems and they believe the student may harm other children, they generally warn their own children to stay away from that student, as far as we have observed." (P6)

"As long as there are no aggressive behaviors, parents of other students do not have a negative perspective regarding this situation." (P10)

Table 8.
Diagnostic groups that school counselors find challenging

Theme	Codes	f
Challenging diagnostic	Autism Spectrum Disorder	5
	Attention Deficit Hyperactivity Disorder (ADHD)	4
	Co-occurrence of learning disability and ADHD	3

Theme groups	Codes	f
	Impulsive behaviors	3
	Learning disability	2
	Severe disabilities	1
	Developmental delays	1

Table 9.
Challenging Situations Experienced by Guidance Counselor

Theme	Codes	f
	Persuading parents / parental cooperation	5
Challenging	Feeling inadequate	4
situations	Behavioral problems	4
	Communication difficulties in autism	2

As shown in Tables 8 and 9, the diagnostic groups and situations that guidance counselors personally find most challenging are presented. The counselors stated that they experience the greatest difficulty, respectively, with students diagnosed with autism (n = 5), ADHD (n = 4), students with both learning disabilities and ADHD (n = 3), and students exhibiting impulsive behaviors (n = 3). A smaller number of counselors also reported that students with learning disabilities (n = 2), severe disabilities (n = 1), and developmental delays (n = 1) were challenging for them.

"I had two students who were diagnosed with both learning disabilities and attention deficit. Their situation was a bit more severe. Because when a psychiatric referral is made, the parents do not follow through. During that period—sometimes up to six months—they do not go. The student uses medication, and while using medication, significant behavioral problems occur." (P3)

"Students diagnosed with ADHD often find themselves unintentionally involved in problematic situations due to impulsivity; therefore, we can observe behavioral problems (especially when the family does not cooperate in the treatment process). With gifted students, we also experience difficulties related to social adjustment." (P9)

"Communication difficulties may occur with students diagnosed with autism. Problems can also arise in the classroom environment with students who have hyperactivity. They may distract their peers and teachers. In addition, when inclusive students experience medication changes or discontinuation, sudden mood changes may lead to behavioral problems at school." (P11)

Discussion Conclusion and Suggestions

In this study, school counselors' views on inclusive education practices were examined in terms of the problems reported by inclusive students, teachers, and parents, as well as the counselors' own professional experiences.

School counselors stated that inclusive students generally experience social anxiety/social adjustment difficulties and academic problems. This finding is consistent with previous research, which indicates that deficits in social adjustment/social anxiety and academic development are among the most frequently reported problems for inclusive students by both school counselors and teachers (Parlak, 2017; Cansız & Bayar, 2024). In addition, counselors noted that when inclusive students do not display behavioral problems, they are more likely to be accepted in the classroom. Similarly, Yıldırım and Kılıç (2024) reported that behavioral problems significantly affect peer acceptance.

The most frequently reported problem communicated to school counselors by classroom and subject teachers working with inclusive students was their inability to keep up with the curriculum and to allocate

additional time for inclusive students. Studies by Kargın, Acarlar, and Sucuoğlu (2005) and Cooc (2019) yielded findings consistent with this result. This situation may be explained by the inadequacy of systems designed to support both teachers and students in inclusive education practices. Furthermore, school counselors reported that some teachers objected to inclusive education reports, considered students unsuitable for their classrooms, and experienced difficulties dealing with the behavioral problems of inclusive students. Similarly, Klingner and Harry (2006) found that teachers frequently questioned students' suitability for inclusion and objected to diagnostic decisions during meetings. Babaoğlan and Yılmaz (2010) reported that teachers felt inadequate in managing behavioral problems and expressed a need for support from school counselors or special education specialists, while Altun and Gülben (2009) demonstrated that teachers' classroom management difficulties were closely related to the behavioral characteristics of inclusive students.

Parental approaches were examined in two contexts: parents of inclusive students and parents of other students in the classroom. School counselors reported that some parents of inclusive students were anxious and concerned, whereas others were constructive and open to collaboration. The literature supports the view that parents of inclusive students—who are among the key stakeholders in the process—generally perceive inclusion positively in terms of social acceptance, equality, and the development of their children's social skills (De Boer, Pijl, & Minnaert, 2010). On the other hand, concerns about their children's adjustment to school and peers, potential academic difficulties, exposure to bullying, and acceptance by others may persist throughout the educational process and may intensify, particularly during school transitions. Regarding the attitudes of parents of other students in the classroom, the present study found that when inclusive students displayed behavioral problems, other parents often did not want these students in the classroom, whereas some parents adopted constructive attitudes. Given that both parent groups included individuals who were constructive and open to cooperation, it is considered important to systematically implement efforts aimed at fostering acceptance and positive attitudes among all parents, as well as providing structured information sessions and meetings that address parents' concerns and suggestions.

School counselors identified autism, ADHD, the co-occurrence of learning disabilities and ADHD, and impulsivity as the diagnostic groups with which they personally experienced the greatest difficulty. The most challenging situations reported included persuading parents and establishing cooperation, feelings of professional inadequacy, and managing behavioral problems. Supporting these findings, previous studies have shown that school counselors report weak staff relationships related to inclusion, insufficient communication between families and teachers, and a lack of resources tailored to students' needs (Bani Odeh & Lach, 2024); difficulties in collaborating with families and school administration and bearing the primary responsibility for developing individualized education programs (Karalar, Bogenç, & Kargın, 2024); and feelings of inadequacy among school counselors and guidance and research center staff regarding inclusive practices, disability types, and informing families (Güven & Balat, 2006).

The findings of this study, which describe the experiences and views of school counselors who play a crucial role in inclusive education practices, once again highlight the necessity of support services in inclusion. For inclusive education to be successful, it is essential that support services be comprehensive, continuous, and open to collaboration; that students and parents be adequately informed and supported; and that all teachers, including school counselors, enhance their competencies regarding the adaptations required by inclusive education and the management of students' behavioral problems.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Socio-psychological parameters of Blended learning

Eleni Karasavvidou [1]

Abstract

There is a growing discussion about blended learning. In the post covid era (pce) it is considered by some a method that can address and enrich autonomous learning behaviors, using social interaction and playfulness as factors of motivation for both learners and teachers. And yet a significant part of the discussion omits the diversifications and sociocultural gaps enlisted in pce, assuming there is only one definition about it. Covid itself evolved in an environment anything but neutral, where social, cultural, financial evolutions marked an epoch of blistering changes under the blended spectrum of multiculturalism, new technologies and neoliberalism, influencing the actual covid experience and the post covid syndromes evolved ever since.

Having a background in intercultural education and an actual involvement in related social movements, in our paper we discuss the plasticity of motivation and achievement blended learning can offer or deprive. Using the method of bibliographic review and considering experiences we have had 'in the field', we pose questions such as: a. blended learning and migration/refugees b. blended learning and economic/technological gap c. blended learning and its gender dimensions.

We conclude that blended learning, despite its potential, is shaped and practiced on western middle-class learning styles that also dominate formal education, despite the advances that have been made. Although the issue is left open, we suggest ways to address it using newer adult education strategies that can be integrated into formal education such as ‘futuring’, adapted, however, for broader groups experiencing social exclusion.

Keywords: Blended Learning, social exclusion, critical theory, inclusive pedagogy

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Introduction

We live in an era of blistering changes that transform profoundly our perceptions of the world and its institutions, along with our functions within them. As a result, the need to reinvent our personal and collective self, along with our institutions, evolves constantly in any important domain and education is no exception. Given the ever-increasing involvement of new technologies in education, and overall, in society and in economy, but also the new understandings of 'literacy' that are already evolving in relation to them, blended learning, part of multimodal education and with significant influence on youth culture, has acquired distinct academic and practical interest and momentum. Yet, the development of information technologies brought, in addition to benefits, some negative aspects also, related to class, gender, cultural factors. But, exploring the existing literature and research, we argue that the very limited research and literature concerning them marks the dysfunctional communication between information technologies and humanities.

The general context

If we could accept something as a social or historical "given", is that in a great extent, societies evolve because the social and the economic activity changes the natural and social circumstances in which any person (with all his or her distinctive characteristics) is shaped and functions. Technology, being a basic parameter in the sociocultural structures, and thus of economic activity, was for centuries the most systematic way of environmental adaptation we had created. At the same time, it was also related to the complicated system of power relations that evolves between persons and groups. Technology, limited until yesterday to the kind of production and from the distribution of labor (Touraine, 1992), was maximized and autonomized, turning itself into a factor of social change the recent decades.

As a result of technological progress and its widespread use at young ages, at least in the 1st and 2nd world, a descriptive term has been proposed, classifying the 21st century as the century of Digital Society for these generations: Digital Natives. As early as the turn of the century, Prensky (2001) argued that teachers who have been in educational institutions for over twenty years are immigrants in the world of cyberspace because they were born and functioned into a different social and educational context, having to acquire knowledge in different ways than those used today by digital natives (Santos, Scarabotto and Matos 2011). Their educational practices are different from the way students perceive knowledge, and understand its production and its distribution nowadays, which often leads to pedagogical inadequacy. These generations of 'digital natives', sooner or later, would cause a wave of pedagogical innovation, in clear combination with technological innovation.

And yet, the availability of content that cyber information 'offers', that is not necessarily appropriate for the age of its consumers, highlights the need to train children to develop critical thinking, aesthetic criteria and methods of responding to the multimodal literacies that our time demands.

Young people, teenagers and children, through constant exposure to ICT and daily cognitive coexistence with a variety of digital platforms and gadgets, acquire new, multi-tasking, skills that should enable them to the new educational paradigm, with technological challenges that are increasingly advanced and multifaceted. But this task should not omit the very core of humanistic education and should include the development of critical thinking, empathy and ability to exercise a multifaceted network of informations in fast, critical and productive ways, that will enrich society and pedagogy in general. As stated in the European Commission's report, The Changing Pedagogical Landscape: New ways of teaching and learning (2015) the implications of this new reality for the higher level of education policy must concern the work of Institutions and teachers, who are essential in this process of change, and should be supported in this appropriation of pedagogical innovation (OCDE, 2018).

But what are the main characteristics of this transition? According to Caeiro (2015) we may trace and explore three levels of socio-cultural change, which we have not yet adequately realized:

1. Today, knowledge and intellectual production in general are not produced exclusively - or primarily - in educational institutions (schools / universities): Citizens have the possibility to access more and more easily the vast online universe; where they shape opinions and delineate attitudes. • The education system finds active competition in these new networks of knowledge dissemination -communication

and research based in private business systems/interests far outside the traditional control exercised over them by institutional education under academic intellectual authority.

2. The increased volume of information that circulates in society, also causes an increase in complexity in relation to valuation and analysis and therefore calls for innovations, because the stability& knowledge about something seems to have a short cycle of duration, in a world of new and diverse sources of knowledge and Personal navigations that are integrated into the production knowledge structure.

3. The logic of the organizational structures of knowledge is changing: The linearity that dominated the period of the hegemony of the written medium disappears under the dominance of the mosaic of information and stimuli that the electronic and digital environment imposes. • The logic of time and accumulation is transformed. According to the continuous flow model, qualitative changes occur continuously and do not depend on the quantitative accumulation of information (Porto and Moreira, 2017, pp. 8-9).

In fact, to realize and to deal with these challenges, acquire new skills in knowing, understanding, analyzing, interpreting and creating productive knowledge. According to the Pedagogical Institute of Greece (2011) , using ICT in class, no matter how thematically related it is to a subject, should not remain solely for aesthetic enjoyment, despite its inherent value, but should also justify its use as an important educational tool of the modern era, contributing to the expansion of knowledge itself, its definitions, and its possibilities of intervention for the benefit of education and of a 'confused' society in search of less violence and more cohesion. Thus, it is not enough to integrate technologies into the classroom and add them as educational tools to a traditional approach. We must integrate the appropriate poly-literacies, bearing in mind the level of education, the scientific field of teaching and research and most of all the socio-cultural context that marks them all, and what we must succeed in it, defending the core values of education. And that makes any research that connects new technologies with humanities important.

Blended learning

“Blended learning, often referred to as hybrid learning, integrates traditional face-to-face teaching methods with online educational technologies, creating a dynamic and flexible approach to education (Ojaleye & Awofala, 2018). This model offers a balance between synchronous (real-time) and asynchronous (self-paced) activities, allowing learners to access content at their convenience while still benefiting from structured, instructor-led sessions (Dhawan, 2020)” as cited in Ekene-Collins, Nnalue, & Alado, (2025, p. 2226).

Blended learning is reshaping education by combining traditional classroom instruction with digital tools and online resources, offering a dynamic and personalized learning experience, in a more flexible learning environment, based on mix of in-person lessons, digital resources, and interactive online content. And yet a significant part of the discussion omits the diversifications and sociocultural gaps enlisted in it, that apart from flexibility will contribute to its effectiveness, assuming there is only one definition about it. Covid itself, a factor that generated distance learning[1], evolved in an environment anything but neutral, where social, cultural, financial evolutions marked an epoch of blistering changes under the blended spectrum of multiculturalism, new technologies and neoliberalism, influencing the actual covid experience and the post covid syndromes evolved ever since.

All Types of Blended Learning, the Flipped, the rotation, the Face-to-Face Driver Model, Flex Model, the Enriched Virtual Model require careful lesson planning and classroom management to ensure smooth transitions between activities and that each station adds value to the learning process (Neumeier, 2015). But most of all it requires recognition of the already existing gaps addressed to minority groups, gaps that have maximized under the realm of neoliberal economy and its minimalistic state that leaves unprotected those under social exclusionary practices.

[1] Although there are differences between Emergency Remote Teaching and Online Learning (Hodges at all, 2020) in https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning as accessed 12/8/2025

Scholars of blended learning point that three types of presence (Cognitive presence - Social presence - Teacher presence), are important in order the blended, or in fact any kind of digital learning, to be functional (Whiteside and Dikkers 2008), and that without strong self-discipline and motivation, some learners may struggle to keep up with coursework. Additionally, not all subjects are well-suited for fully online instruction, particularly those requiring hands-on practice, such as lab sciences and performing arts, in a context that already humanities are under attack. But self-discipline and motivation regarding knowledge or its outcome and effectiveness are anything but neutral. Gender, class, special needs, geopolitical segment etc, do play an important role raising questions at the 'core' of the discussion about what it means to make the political more pedagogical and the pedagogical more political.

The gender factor

Discussions about different forms of lifelong learning emerged in the late 1960s when Coombs (1968) raised the issue on the global educational crisis. Three forms of learning were distinguished, formal, non-formal and informal. Formal learning in which we mostly refer is "the highly institutionalized, chronologically graded and hierarchically structured 'educational system', extending from lower primary school to the upper parts of the university" (Coombs at al, 1973, p. 8). The different types of learning into which we divide education take place «in a much broader process that holds in a lifelong paraprogram" (Boeren, 2011, p. 4). This paraprogram, 'naturalizing' dimensions such as class, gender, age and race, and the related hierarchical orders, affects the ability to acquire cultural capital that helps in information and participation (Fairclough, 1995, Field, 2009), and becomes the main reason that entire population groups cannot participate equally even in eras of high technology, where learning processes like blended learning f.i. could be easily accessed. This cannot be really comprehended in our more over well included microcosms. The very schooling itself is based and 'commonsensically', (aka without questioning), adapted on the experiences and ways of learning of the white middle class (Patterson, 2017).

In other words, institualization in a social context with given inequalities results, normalizes and reinforces an educational paraprogram (Hall, 1997, Freire, 1998b) that constructs a long standing, hegemonic, gender-blind narrative as a prevailing tradition, naturalizing gaps (Bourdieu1973).

In this educational context intersectionality (aka the relation between multiple minority identities such as gender, class, race, sexual orientation etc) is a key factor that needs to be addressed.

The recognition of the different ways of knowing and thinking of women, something that is ignored in formal education" (Tsiountou, xx, p. 57) and obviously the ways of evaluating it, is one of the achievements humanities offered since the late 20th century. Other research (e.g. Belenky et al., 1986) have shown that women have higher emotional intelligence "and use intuition and emotion in evaluating and understanding things".

This function also affects mobility (Hearn, 1982) since, in the majority of cases, and despite the existence of 'tokens', i.e. symbolic women in various spaces (who are even seen as 'a sign of favoritism at the expense of the majority', receiving polarized evaluations, (Williams, 2005), the statistics remain extremely unequal and increase the higher in the hierarchy a work or social position is (Tate and Yang, 2015). The breadth and social acceptance of this phenomenon led Carr (2001) to define it as a 'gender gap' even in spaces that define themselves as 'progressive', such as universities or educational environments or hyper-technological ones,'self-admired' for a false neutrality.

Women are more likely to bear the burden of domestic responsibilities, impacting their ability to engage fully in blended learning and further limiting their time and ability to participate in general in educational activities (Aditya & Permadi, 2020). The social roles women attributed with, the domestication of their activities, the structural reproduction of patriarchy in the educational system and the labor division in society, are not taking into account in a substantial way when a techno-education program is constructed. The very timeline of blended reality programs, deprive many women from low-income sectors of society to participate in equal terms. And despite 'online education, including online teaching and learning, has been studied for decades' (Hodges at al, 2020) the persistence of this phenomenon has not been evaluated it as important so far. The rare, blended learning studies in relation to gender confirm both the educational exclusion based on gender and the priorities of the given status and also the priorities of the

research, alienating the most dynamic educational sector of our era from humanities and critical pedagogy.

For instance, a study (one of the few, published just in 2025) that examined the impact of gender dynamics and infrastructural challenges on the implementation of blended learning in higher education, revealed that "while both male and female students benefit from blended learning, male students demonstrate marginally higher engagement and academic performance. Additionally, infrastructural challenges, including inadequate ICT resources and unreliable internet connectivity, hinder the effective implementation of blended learning, particularly in rural areas" (Ekene-Collins, Nnalue, Alado, 2025, p. 2226). In these areas the domestication of women along to the limited time due to domestic responsibilities, and the under-equipment households influence their access to hyper-technological educational practices furthermore. So "The study identified a preference for offline over online learning modalities due to these limitations, emphasizing the need for targeted infrastructural investments and gender-sensitive policies to enhance inclusivity. Recommendations include providing digital tools for female students and improving ICT infrastructure to bridge the digital divide and maximize the potential of blended learning. These findings contribute to the discourse on equitable and sustainable educational practices in developing contexts (ibid, p. 2226). Gender dynamics such as self-image, lack of motivations, expectations, domestication, social roles attributed to women etc affect their access and performance in education in general and in domains considered 'a window to the world' such as digital learning.

The research only recently started to explore their impact. Njock et al (2024), connecting it with characteristics such as dysgraphia, explored how participation, engagement and performance in blended learning can be influenced by gender, because of additional socio-cultural barriers. The very few yet important surveys, such as the ones mentioned above, propose gender-sensitive instructional design, flexible scheduling, and socio-psychological support backing the actual technology. But "despite the purported use of blended learning models to enhance access to education, there is little information on how they can be better adapted to the specific needs and challenges faced in fragile contexts"[1] (Dridi at al, 2020). The technological and educational world themselves, if they truly care for inclusion that will lead humanity, and the kind of innovation that will permit technology's full potential to grow must address this 'hidden' reality.

The geopolitical factor

But if in general gender disparities hold a critical role in shaping access to, and engagement with, educational technologies, this acquires higher dynamics in developing context. These dynamics come from a long tradition, which was used not only to structure the social subject within the West but also to consolidate colonialism.Western civilisation, based on individual development and strictly concentration, was constructed at a significant extend after Middle Ages on the idea of the (industrial) "machine", using it as a signifier of the way to a successful life (Sutton Smith,1986, p.85). This idea of progress and success had an impact in the world view and educational perceptions (not accepting "uncontroled" characteristics and not counting the initial inequalities people face), and consequently an impact on the ways of teaching. Through this process, mechanical toys themselves, an 'ancestor' of today's technologies, came to symbolise the idea of a separate status for bourgeois segments of population having access at them, a status manifested in particular types of activities. Addressed initially to children (Schwartzman, 1979) this social order soon transcends the age category and became a part of the homogeny process (Jenks, 1996) where adult world became desirable for children, and the western world became admirable for the rest. Being the keyholder of technological progress west naturalized its hegemony, projecting developing or under-developed countries «as incapable of taking care their own business» (Popescu,1998). To call western world as the 'machine of world progress' is a fair and realistic statement, to admire support and expand technological creativity and efficiency is a task of high priority, but neither cannot be completed without addressing the unequal relations it encompasses like the relationships between the first and the second world. In other words, technology, its comprehension, its

[1] Although the survey concentrates on refugees it draws general conclusions for socially excluded environments,

literature and its use in education and in every domain, cannot be addressed as neutral factor, but -like in gender- it should be placed within the framework of power relations, connected also with geopolitics too. Machines and mechanical toys, equally so, along with school, books television and eventually computers - were going to become components of the symbolic literacy of the "informational society"- constructing the ultimate cultural imaginary of nowadays, constructing world-views.

This context, thus, also talks about the relevance of geopolitical situation. The irony becomes higher thinking that we export the main raw materials for the manufacture of, for example, mobile phones from developing countries.

It would have been expected, after all the literature and the research, the digital gap, called nowadays as digital divide, to have been minimized to some extent. But the 'explosion' of the new hyper technological communicational tools under the spectrum of neoliberal economy, in fact deepens it. According to a UN 2023 resolution 'Widening Digital Gap between Developed, Developing States Threatening to Exclude World's Poorest from Next Industrial Revolution'[1] and the statistical data of more than 95% percent in developed countries in comparison with the less of 25% percent in developing using internet, manifests the problem and adds to exclusion in the technological wake and preclude progress for developing countries residence. The inadequate infrastructure resulting in poorly equipped internet and problems in connectivity, the high costs for those people, and a lack of digital skills results in the unequal access and use of technology making it even harder.

Haning as a given that it is harder for the majority of their population to access distant learning due to economic, cultural, and social factors in comparison to the majority of West, constructing the so called 'digital divide' between the 1st and the 3rd world, gender has an even stronger negative impact, influencing more the extent to which male and female users can utilize digital learning tools. Studies have shown that women often face greater barriers to accessing technology due to limited financial resources, societal norms, and lower levels of digital literacy (Ofozoba, 2020). For instance, "in Nigeria, the transition to blended learning in the universities is fraught with challenges, including gender disparities and infrastructural deficits, which hinder its full potential. (Ekene-Collins, Nnalue, Alado, 2025, p. 2227). It becomes more unjust if we consider the potentials of such technology. According to Dridi at al (2020) in low-resource contexts, blended learning models can be an alternative to schooling in situations where movement is restricted or where educational infrastructure is weak or nonexistent. In the context of blended learning, these disparities can lead to unequal participation and performance. For instance, in an already difficult context for both males and females female students and rural areas residents 'may have less access to personal computers and reliable internet connections, which are essential for engaging with online components of blended learning' (Inequalities in Digital Proficiency: Bridging the Divide, 2015).

Of course, "the *idea* of blended learning was drawn into political agendas without paying sufficient attention to the fact that institutions would make different decisions and invest differently, resulting in widely varying solutions and results (Hodges at al, 2020), but Gender and Geopolitical inequality is a global issue which champions the marginalization of women at all levels (Ofozoba, 2020) along with vast numbers of global population.

The refugees and immigrants

But the hierarchical diversifications in accessing learning styles and use of new technologies include also the growing number of refugees and immigrants. According to UNHCR[2], 2018 report 'By the end of 2018, more than 74.8 million people had been forcibly displaced worldwide as a result of persecution, wars, violence, or human rights violations. In this fragile context, education provision is a complex but pressing issue. While 'education is a human right enshrined in Article 26.2 of the Universal Declaration of Human Rights' (The United Nations, 1948), only a tiny minority of refugee youth can access higher education (UNHCR, 2016). 'The other 99% makes up a lost generation of young

[1] https://press.un.org/en/2023/gaef3587.doc.htm

[2] United Nations High Commissioner for Refugees

people with no or inadequate access to higher education and a blended learning that does not address their situation doesn't seem to be the solution' (Dridi at al, 2020).

Not only in general substantial education programs in refugee camps are seldom but rarely they take into consideration the actual cultural and living experiences of their participants, articulated around Western education campus models (Halkic & Arnold, 2019).

The lack of adaptation to an environment with the given difficulties of living in a camp, loaded with cultural differences (Crea, 2016) "resource shortages; employment restrictions, capacity limitations and various other social, political, geographical, and economic factors" (O'Keeffe & Lovey, 2020) create challenges and obvious barriers, adding to the levels of user frustration, anxiety, and confusion in a competitive world for the already marginalized. Even systematic literature reviews of the design of blended learning, never consider the different environments and ways of learning (Boelens, De Wever, & Voet 2017). 'I am acquainted with the pedagogies and learning culture in Syrian higher education (more along the lines of didactic instruction and rote memorization). It wasn't initially clear how much of a challenge this would present for the students in a course like ours that requires a shift towards thinking critically. Our work also highlighted the intentionality required of blended learning efforts.' wrote an instructor (Dridi at al, 2020). The majority of courses that refugee learners participate in are rarely contextualized to include the particularities of refugee life, nor are they delivered through means that best reflect the pedagogical needs of refugee students (Crea, 2016). In addition, low success and adoption rates low user comfort levels increase instructor's responsibility and frustration involvement, affecting the potential of both students and teachers. As noted by one of the online tutors from the Kakuma refugee camp (Kenya): Students also voice considerable frustration, and this result is in total contradiction to the finding in West.

Studies about the learning challenges faced by the students in camps has gain a relative momentum: one was conducted by Moser-Mercer (2014) in Kenya. Another one examined the particular infrastructural challenges in three refugee camps using a massive open online course (MOOC):in Azraq refugee camp (Jordan), Kakuma refugee camp (Kenya), and Amman urban refugee center (Jordan). (Dridi at al, 2020) All highlighted the need for suitable engagement tools for students and rescheduling the program and the learning strategies of tutors. The results showed that poor Internet connection in the camps severely impacted both students' and instructors' learning process, motivation and effectiveness (Dridi at al, 2020, O. Keefe & Lovey, 2023). Having as a given researches showed that in light of these intermittent connection problems, the collaborative learning environment helped students navigate the challenges of a blended course, the question what happens when in a multicultural camp where antagonistic dynamics evolve enforced by the lack of sources, is raised. Also, immediate human contact cannot be erased, since research found that the onsite visit of online tutors and the face-to-face interactions had a noticeable impact on the human dynamics of the course by allowing instructors to provide targeted solutions to students' problems as well as by building rapport between the students and the instructional team'(Dridi at al, 2020).

According to UNHCR[1] only 1% of the refugee population have access to higher education as opposed to the one-third of youth globally but 'refugees have strong aspirations for education as a proactive response to their past persecutions and travails (Stevenson & Willott, 2007, Dridi at al, 2020, O. Keefe & Lovey, 2023). But when offered a high-quality education during their exile, they draw attention to the link between education and protection, 'considering education as a long-term development imperative, rather than an immediate operational emergency' (Halkic & Arnold, 2018). According to a tutor on the field it was "crystalized …that education supports the development of innovation and entrepreneurial skills that are essential for employment and economic activity (Hanushek & Woessmann, 2007).

Westernization and Techno-centralization

Technology has amazing potential to be helpful. The integration of the principles of universal design, called Universal Design (UD), for environments, Universal Design for Instruction (UDI) for teaching,

[1] UNHCR. 2016. " Missing Out: Refugee Education in Crisis." Pp 30–31 https://www.unhcr.org/57d9d01d0(open in a new window)

and Universal Design for Learning (UDL), is promoting self-determination and self-protection among learners with disabilities. Yet, in cases of social exclusion, the difference between emergency-learning and well-constructed learning (Hodges at al., 2023) nor the special needs of those referred to are acknowledged in a systematic way so far. Even the approach of the courses to succeed these important goals seem to be constructed under the spectrum of westernization and of a techno-centralization (our own term) that fails to consider in at least equal terms the complicated dynamics and sentimental investments that act in the learning field. As the research evolves, the question beginning to occur is not related to the offer and the conducting of learning programs but by the conditions under which they are carried out. "At the heart of this question are the issue of contextualization and a call for greater emphasis to be placed on blended learning approaches that better reflect the realities of refugee learners" (O' Keefe, Lovey, 2023).

'In the absence of a binding legal framework, infrastructural problems, inherent to any refugee context, are amplified and make any educational interventions particularly challenging' (Dridi at al, 2020, also Halkic & Arnold, 2018). Yet, some of the challenges associated with implementing blended learning courses in fragile contexts are inherent to computer-supported learning (Dridi at al, 2020), pushing f.i. MOOC designers to redesign the course elements for developing country researchers (Murugesan, Nobes, &Wild 2017) "In this case, MOOC designers intentionally developed low-bandwidth instructional elements in order to take into consideration the limitation of computer-aided learning in low-resource locations" (Dridi at al, 2020). Although not enough yet. the emerging research…:supports the need for greater thought and investment into higher education programs that suit the specific needs of refugee learners, rather than importing courses not designed for these learners or the context in which they live. For example, a meta-analysis of research into HERC (Ramsay & Baker, 2019) found that it was enriching and rewarding for refugee students and could meet their distinct needs when it was rendered relevant and meaningful to those who participated in it."

In general, the Performance in Blended Learning are implemented to Critical Success Factors, divided into three categories: human factors, content and learning factors, and institutional factors. The latter addresses bit just programming and functions but the ways Race, Gender, Class, Specia; Needs etc react with them. "Theories and models have been proposed to explain the relationships between the intrapersonal factors that influence students' learning performance, including motivation, emotions, cognition, and metacognition' (Acosta-Gonzaga, E., & Ramirez-Arellano, A. 2021). Studies in relation to ICT have also compared the effects of students' emotions and motivation in different learning contexts (Butz et al., 2016, Daniels & Stupnisky, 2012), demonstrating that learners need to understand their role in blended learning, shape their attitudes and engagement, and motivate themselves to achieve good learning outcomes (ibid), but their comparison is about anxiety and boredom between face to face and distant learning omitting the sociocultural factors that affects them. The relationship between 'intrinsic factors that influence learners performance' (ibid) and institutionalization must also address expectancy-value, attribution, social-cognitive, and self-determination theory, all in a constant dialogue with our self and collective image while the latter are severely influenced by our thesis in hierarchy, its evaluations and the percentages it constructs us as persons and social subjects without erasing personal qualities and differences.

The role of positive emotions is important in blended learning and in marginalized frameworks where negativity prevails it is hard to establish it and use it in equal terms. And yet, even the fact that studies found centralize exclusively as 'critical success factors that influence learners' only availability of an online system or environment, and the self-efficacy in using computers and online learning, proves the technocentric perception that omits other critical social and psychological factors.

Thus, the access of socially excluded to new forms of education like blended learning only if takes into consideration the social cultural and financial gaps they face, might improve both sides in the benefit of the world.

The Futuring

The most educationally structured aspects of critical pedagogy question the ways in which the social imaginary that defines our lives in every field is structured, an imaginary now indirectly and directly involved with hyper-technology. Therefore it should include in the critique and the counter-proposals,

the privileges act in the field and the power associated with them, aiming at the personal change and the empowerment of users and producers of pedagogical content.

An approach that has been proposed in recent years, originating from minority education in relation to gender, is Futuring, a strategy that "must 'keep in mind' those who work for social transformation and healing in communities that/…/ are dysfunctional in periods of rapid change, social conflict and ambiguity, /../ as they can be used to explore situations that need new approaches and social action".

The so-called Futuring (Fleener and Coble, 2022, p. 4) "provides a framework with a specific focus on care and interaction with each other and with the environment, offering guidance for the emergence of collaborative models for more connected, empathetic, just and harmonious forms of coexistence. "

This approach, as noted, falls within the boundaries of post-structural critical epistemology, ontology and ethics and the epistemological, ontological and ethical parameters are not negligible. Futuring focuses largely on critical literacy and extends, or tries to systematize, efforts to transform social discourse so that we critically engage existing narratives and understand the historical contexts that contributed to their creation. One of its central goals is to create new, "emerging narratives with a particular emphasis on equality and justice" (p. 7) that will potentially influence ways of thinking and acting. If we study, for example, the narratives that AI offers and its increasing use in this light, we understand more deeply how it is not neutral and contribute to a critical approach that will stand up to the golden armor of techno-teaching.

Futuring, however, has something in common with new technology: it embraces a postmodern, post-structural stance emphasizing nonlinear, unpredictable, undefined possibilities that require transformative approaches to deeper knowledge and corresponding action. By emphasizing the process of delegitimizing colonization, hegemonic and categorical thinking and the corresponding social structures, it extends critical theory on the postmodern, (Capper, 2019), thus placing, from its own perspective, the bet on social transformation. This epistemological stance implies "relational ontology and ethics opening up spaces for imaginative possibilities and alternative ways of knowing and coexisting in a social world that needs "transformative spaces for the creation of alternative visions" (Inayatullah, 1990, p. 815).

In this still promising, 'uncomfortable' and unexplored field of recent years, they offer an opportunity to explore more deeply the connection and interaction between our educational practices and the power relations they entail, the dominant cultural norms and their historical origins, the legitimizing discourse that arbitrarily impersonates the language of the entire society despite its 'partiality' and not only prejudices. Even the systemic policies and practices that are considered supporting perpetuate and promote unequal opportunities and experiences in the field of education.

Futuring might offer in: a. Challenging Normative Frameworks: realizing the need to construct programs not just influenced by the western campus mentality but nased on the peculiarities of fragile contexts and cultural differences/obstacles of the margins. b. Examining Historical Erasure: how dominant narratives can erase or marginalize certain experiences. c. Fostering Critical Consciousness: a critical awareness of how social norms are created, perpetuated, and distributed through blended learning promoting a change of the dominant paradigm.

d. Creating "new'' Possibilities: By disrupting untouched interpretations of new technologies creates a space envisioning futures beyond the constraints of a class gendered white world e. Promoting Activism and Social Justice: This type of critical inquiry equips students with tools to question and transform dominant social structures, contributing to broader activism and advocacy that will realize the use of pte is not equal in the first place, neither are its narratives (Inayatullah, 2008). This will enable both students and educators to demand a more equitable distribution and use of new technologies aiming at an inclusive society where diverse identities are not only recognized but also affirmed. These connect futuring with intercultural education practices and perspectives.

Discussion-Conclusions

In an era of a growing populism, where mediated identities are based on the media- controlled model of public opinion and image, fabricated by cybernetic capitalism, Critical pedagogy, giving space to

marginal presences, raises questions of ethics linked not only to minority status and its supposed or imposed identities, but about the very nature and essence of humanity and education (Freire, 1998a). In doing this it challenges cultural consensus and homogenization of a linguistic, ethnic, social, cultural or sexual dominant paradigm.

Technology and innovation zeitgeist in international development, serves as registration of individual and collective success and of a lived culture. A culture which, if centered on inclusion and not just in its own progress, can re- establish cultural dialogues (in a global order which prefers to 'educate' mostly on signifiers and surface), "turning ICT into a disturbing question mark about the past, the present and the future of our learning culture". The exclusion stemming from factors like gender, class, race. geopolitical context, special needs must lead into tools that would 'be built around responsible pedagogical models that engage learners to interact with each other on the ground and allow them sufficient time to engage asynchronously with the learning material' (Dridi at al, 2020).

The reality outside labs underscores the need for inclusive policies to address the various disparities and social exclusion. By leveraging technology, it is possible to expand access to quality education, equally for both women and men, locals and refuges, privileged and proletarians, particularly in developing, remote and underserved areas, regardless of if they are hidden in underprivileged areas of the west or belong to the developing geopolitical context. "In an increasingly interconnected world, educational systems must meet the needs of diverse learners from varying cultural, linguistic, and socioeconomic backgrounds" (Leong, 2025). By addressing existing barriers and leveraging its potential, education can create more equitable and effective learning environments that cater to the diverse needs of their student populations (ibid), it 'can mitigate disparities and enhance equity' (Ekene-Collins at al., 2020). That "cultural imaginary" has the urge to adjust our collective self into the new era without losing the core values of pedagogy, in other words, its duty to contribute into a better world.

The limitations of this paper is a given, given the limited research. Also, the inter-relations between futuring as an alternative educational approach and an inclusive blended learning should also be explored further. But the dialogue must open and lead to improved perceptions of the topic at stake Approaches like Blended Learning are important but need to face racial, class and 'gender oriented specific challenges' (ibid) and to be built around responsible pedagogical models that will enable marginalized learners to participate more successfully. In doing that the techno-centric and western-centric research must promote tailored support, considering their special history and framework in relation to the dominant pedagogy that is alive and kicking even in new approaches like ICT. And, then, allow them sufficient time and process to engage synchronously and asynchronously with the learning material, promoting critical and empathetic learning, in the benefit of both new technologies and our world.

Addressing disparities in educational technology is crucial for ensuring the success of blended learning initiatives (Aditya & Permadi, 2020). This requires the implementation of gender-sensitive policies, such as providing scholarships for female students to acquire digital tools and offering training programs to enhance digital literacy among women. By promoting gender equity in access to technology, universities can create more inclusive learning environments that empower all students to succeed (Agim, at al, 2024).

The challenges faced by students in fragile contexts, especially those who have multiple minority identities, the so called inter-sectionality shed light on the limitations, when implementing blended learning and the deficiencies provided by a class, gender, ethnic environment, sustaining a hierarchical order of the world that hyper-technology can never on its own erase.

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Artificial Intelligence In Primary Education

(Perspectives of Student Teachers)

Yanka Stoimenova[1] Valentina Chilvea[2] Maria Mladenova[3]

Abstract

This study examines student teachers' attitudes and readiness to integrate artificial intelligence (AI) in primary education, focusing on perceived benefits and limits, expected effects on engagement and inclusion, familiarity with concrete tools, and self-assessed digital and ethical competences. A cross-sectional survey was administered to 108 students enrolled in primary teacher-education programmes. The questionnaire, delivered via Google Forms, combined closed items on a five-point scale with short open questions. Scales covered attitudes to integration, usefulness and limitations, confidence in working with young learners, privacy awareness, and anticipated effects on motivation, engagement, differentiation, and inclusion. Familiarity checklists captured knowledge of specific tools. Internal consistency exceeded conventional thresholds, and descriptive statistics were complemented by simple subgroup contrasts. Open responses were thematically coded to contextualise quantitative patterns. Support for integration was the dominant stance, with around six in ten respondents agreeing that AI should be part of primary teaching and learning. Expectations for pupil motivation and day-to-day engagement were positive overall. Most respondents viewed AI as a complement to, not a replacement for, teacher-pupil interaction. Just over half agreed that AI can assist inclusive practice. Familiarity clustered around one general chatbot, reported by 76 students, while intention to use it was lower but substantial. Awareness of other categories, such as adaptive practice applications and platform-embedded features, was modest. Correlation patterns linked endorsement of integration with higher expected learning benefits, motivation, and inclusion. Confidence in judging age appropriateness was associated with stronger inclusion beliefs, and privacy awareness showed smaller yet positive relations with motivational and benefit indices. Preferred classroom uses prioritised adaptive assessment and AI-supported differentiated tasks, with instant feedback and dynamic grouping selected less often. Student teachers are open to AI in primary settings, yet preparedness is uneven and concentrated on a single tool. Programmes should convert interest into safe, purposeful practice through authentic, curriculum-tied tasks, a broader tool repertoire, and routine checks for accuracy, readability, bias, age fit, and privacy. Keeping the teacher central while using AI to support planning, explanation, feedback, and differentiation offers a pragmatic route to motivation and inclusion gains for young learners.

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Keywords: artificial intelligence, primary education, digital educational resources, teaching and learning process, teacher support

Introduction

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The introduction should provide a clear background for the study, establishing its significance and relevance within the field. Authors should define the research problem, outline the study's objectives, and present the research questions or hypotheses. A brief discussion of the study's novelty and contribution to existing knowledge is also expected.

Digital technologies are reshaping lesson design, feedback, and pupil engagement. Artificial intelligence adds tools for adaptive materials, rapid formative feedback, and planning support, yet impact is determined by sound pedagogy, clear safeguards, and teacher capacity rather than by technology alone (Boulhrir & Hamash, 2025; Brito & Martínez, 2024; Johnston et al., 2024; Mosher et al., 2024). Primary education warrants particular attention, since the early years lay cognitive, emotional, and social foundations through close teacher guidance. Evidence indicates that children approach new technologies with curiosity while also expressing concerns about fairness and safety, which points to age-appropriate, teacher-led use (Walan, 2024). Teachers and pre-service teachers often recognise potential for differentiation and inclusive practice, but report uneven preparation and unresolved ethical questions (Mazı & Yıldırım, 2025; Yilmaz & Arslan, 2025; Kazmaci & Yildirim, 2025). Classroom illustrations suggest that AI is most valuable when it supports, rather than replaces, interaction and explanation, including in STEM tasks and concept teaching (Abualrob, 2025; Lee & Song, 2024).

Understanding pre-service teachers' views is therefore timely, as their beliefs and skills will soon shape classroom practice. Existing studies tend to find positive attitudes, alongside a sense of partial readiness. Intentions to use AI are linked to perceived usefulness, ease of use, and self-efficacy, while reservations concern accuracy, over-reliance, and assessment integrity (Sanusi et al., 2024; Guan et al., 2025; Su & Yim, 2023; Blas et al., 2024; Iglesias et al., 2025). Structured learning activities can strengthen judgement and confidence, encouraging careful and purposeful use in lessons (Hernández & Faber, 2024; Otter & Tondeur, 2025; Duan & Zhao, 2024, 2025; Kai & Cheng, 2025; van den Berg & du Plessis, 2025; Martínez-Moreno & Petko, 2024; Zhang & Xu, 2025). On this basis, a clearer account of student teachers' perspectives on AI in primary classrooms is needed to guide realistic and responsible integration that keeps the teacher central and supports children's development; accordingly, the study investigates pre-service teachers' attitudes and readiness to work with AI tools in primary education, examining perceived benefits and limits, knowledge of concrete applications, and expectations for motivation, engagement, and inclusion, alongside self-assessed digital and ethical competences, with the intention of informing teacher-education courses through practical examples, guidance for responsible use, and practices that prioritise young learners' needs (Bergdahl & Sjöberg, 2025; Cukurova et al., 2024; Mosher et al., 2024).

Literature Review

Recent guidance converges on a straightforward principle: technology should serve pedagogic aims and safeguard learners. European Schoolnet identifies priorities for teacher professional development that include clearly defined roles for classroom use, attention to privacy, and sustained staff support (Cukurova, Kralj, Hertz, & Saltidou, 2024). At programme level, institutions are urged to align course design, assessment, and safeguarding before introducing new tools in practice placements or coursework (Johnston, Jameson, O'Keeffe, & Raines, 2024; Mosher, Dieker, & Hines, 2024). Reviews of early-years innovation similarly stress that technology must be anchored in learning intentions and child development rather than in novelty value (Boulhrir & Hamash, 2025).

Within the European context, professional development materials emphasise practical classroom scenarios, transparent data practices, and teacher agency in adoption decisions (Cukurova et al., 2024). National and institutional policies increasingly call for clarity on assessment integrity, disclosure of tool

use, data protection, and age-appropriate application, with implementation channelled through teacher education and local school policies (Johnston et al., 2024). Sector overviews advocate institution-wide frameworks that balance innovation with accountability and accessibility so that new tools do not exacerbate inequalities in provision (Mosher et al., 2024). Across these documents, the common thread is teacher preparation, learner protection, and continuous evaluation.

Syntheses describe AI in education as techniques that pattern-match from data to generate or recommend content, make predictions, or offer feedback, with educational value determined by the instructional framing rather than by the tool itself (Boulhrir & Hamash, 2025; Mosher et al., 2024). Classroom-facing studies present AI as tutor, tool, or teaching aid, depending on task demands and the degree of teacher mediation (Abualrob, 2025; Lee & Song, 2024). In teacher education, research frequently links AI use to established models for technology integration, aligning resources with curricular targets and learner needs (Johnston et al., 2024).

Findings from primary settings combine promise with caution. Pupils report curiosity and can articulate risks such as fairness and safety, which supports guided use and explicit discussion (Walan, 2024). Teachers and pre-service teachers identify potential for differentiation and inclusive practice, while also noting gaps in training and confidence (Mazı & Yıldırım, 2025; Yilmaz & Arslan, 2025; Kazmaci & Yildirim, 2025; Babaoglu & Durur, 2024). Lesson-level reports point to practical gains when teachers use tools to plan tasks, generate examples, or provide targeted feedback, while retaining final judgement and explanation (Abualrob, 2025; Lee & Song, 2024).

Across teacher-education studies, attitudes tend to be positive but preparedness is uneven. Intention to use is associated with perceived usefulness, ease of use, self-efficacy, and social influence, while uncertainties about ethics and quality can slow adoption (Sanusi, Ayanwale, & Tolorunleke, 2024; Su & Yim, 2023; Blas et al., 2024; Iglesias, Seifert, & Castañeda, 2025). Targeted activities that build reflection and discussion are shown to strengthen confidence and judgement (Hernández & Faber, 2024; Otter & Tondeur, 2025; Duan & Zhao, 2024, 2025; Kai & Cheng, 2025; van den Berg & du Plessis, 2025). Work on preparedness adds that professional identity and perceived capability evolve as students gain structured experience with tools (Guan, Zhang, & Gu, 2025; Martínez-Moreno & Petko, 2024; Zhang & Xu, 2025), and comparative research indicates that readiness varies by context and programme, which argues for locally adapted training (Iglesias et al., 2025).

The most consistent opportunities cluster around personalisation, feedback, planning, and inclusion. AI can help tailor materials and pacing for young learners and can reduce routine workload, creating more time for interaction and assessment for learning (Boulhrir & Hamash, 2025; Brito & Martínez, 2024; Mosher et al., 2024). In primary STEM, teachers report support for scaffolding explanations and creating practice sets that match current levels (Abualrob, 2025; Lee & Song, 2024). In teacher education, well-designed tasks improve confidence, design skills, and classroom decision-making, especially when students trial tools on authentic planning or feedback challenges (Otter & Tondeur, 2025; Duan & Zhao, 2024; Kai & Cheng, 2025), with documented benefits for motivation and career interest when practical examples reduce anxiety and clarify purpose (Martínez-Moreno & Petko, 2024; van den Berg & du Plessis, 2025).

Alongside these opportunities, four recurring challenges appear. First, uneven readiness and limited hands-on experience, which signal the need for explicit training and mentoring within teacher-education programmes (Su & Yim, 2023; Blas et al., 2024; Iglesias et al., 2025; Guan et al., 2025). Second, ethics and safety, with teachers seeking clearer guidance on privacy, bias, transparency, and responsible classroom use, particularly with younger pupils (Cukurova et al., 2024; Johnston et al., 2024). Third, pedagogical fit, with studies cautioning against tool-driven lessons and recommending a start from learning goals and developmental needs (Boulhrir & Hamash, 2025; Mazı & Yıldırım, 2025; Yilmaz & Arslan, 2025). Fourth, sustainability, since beliefs and attitudes mediate long-term uptake and therefore require attention alongside skill development (Kazmaci & Yildirim, 2025; Sanusi et al., 2024). Overall, the literature supports a simple organising idea: keep the teacher central, deploy tools to advance learning aims, and invest in ongoing, practice-based preparation for those entering the profession.

Method

Aim: To examine student teachers' attitudes and readiness to integrate AI tools in primary education.

Objectives

- Identify perceived benefits and limitations of AI.
- Assess familiarity with specific AI-based tools and applications.
- Analyse views on pupil engagement, motivation, and inclusion.
- Evaluate self-assessment of digital and basic AI-related competencies.

Design, participants, instrument, and procedure

A cross-sectional survey design was adopted, combining closed items to describe patterns with short open questions to elicit practice-oriented comments. The sample comprised 108 students enrolled in pedagogical degree programmes preparing teachers for primary schools. Eligibility required current enrolment and informed consent; participation was voluntary and uncompensated. Data collection took place during regular semester weeks and outside formal assessment periods.

The questionnaire, administered via Google Forms, contained three sections. The background section asked about programme, year of study, prior classroom experience, and prior exposure to AI tools during study or placement. Closed items employed a uniform five-point scale to examine attitudes, perceived usefulness and limitations, confidence in using tools with young learners, awareness of privacy issues, perceptions of professional norms, and expected effects on engagement, motivation, differentiation, and inclusion. Checklists recorded familiarity with specific tools, including general chatbots, adaptive practice applications, and AI features embedded in learning platforms. Open questions invited concise comments on intended classroom use, concerns, and support needs. Wording was kept in plain language suitable for non-specialists, with instructions reminding respondents to consider primary-aged pupils.

Instrument development and quality checks

Items were aligned with the study objectives and underwent expert review by two colleagues in teacher education to confirm clarity and age appropriateness. A small pilot with eight student teachers assessed timing and comprehension, leading to minor edits that reduced ambiguity. Following data collection, internal consistency for the attitude and confidence scales was examined using Cronbach's alpha, with coefficients above 0.70 treated as acceptable. Free-text responses were optional.

Ethics and data handling

The invitation outlined the study purpose, voluntary participation, an estimated completion time of 10 - 12 minutes, and the approach to data handling. Consent was obtained on the first page. No identifying information was collected. Participation was anonymous and respondents could omit any item or exit prior to submission. Data were stored on a secure institutional drive with access restricted to the research team. The study adhered to standard ethical guidance for research involving adult students.

Data analysis

Quantitative analysis involved exporting responses to CSV, screening for duplicate entries and implausible values, applying pairwise exclusion for missing data, and summarising results with frequencies and percentages displayed in simple bar and stacked bar charts. For multi-item blocks, composite means were calculated when at least two thirds of items had been completed, and Cronbach's alpha was reported to indicate internal consistency. Where subgroup sizes permitted, non-parametric comparisons were conducted across straightforward groupings such as prior exposure (yes or no) and year of study, with effect sizes reported alongside results. All inferential findings were interpreted cautiously.

Qualitative analysis followed a concise thematic procedure. Two researchers independently coded an initial subset of open responses to construct a shared code list covering benefits, limitations, classroom use cases, and support needs, after which codes were organised into broader themes. Discrepancies were resolved through discussion. Themes were illustrated with brief, anonymised extracts and used to deepen interpretation of the quantitative patterns.

Limitations

The cross-sectional design offers a single-time-point snapshot and relies on self-report. The single-context sample constrains generalisability. To mitigate bias, items were worded plainly, internal consistency was checked, and descriptive results were complemented with brief open-ended comments to add context. Findings are interpreted within these boundaries.

Results

All analyses draw on the full sample of student teachers (n = 108). Multi-item indices were examined for internal consistency and satisfied accepted thresholds; descriptive results report exact n, and group contrasts apply pairwise treatment of missing data. Scales are interpreted on a 1-3 continuum in which 1 denotes Disagree, 2 Neutral, and 3 Agree. Findings are presented in the sequence attitudes, engagement, interaction, inclusion, and tool familiarity.

Support for integrating AI in primary education emerges as the dominant stance. Around six in ten respondents agree that AI should be part of primary teaching and learning, a smaller proportion are undecided, and a minority express disagreement.

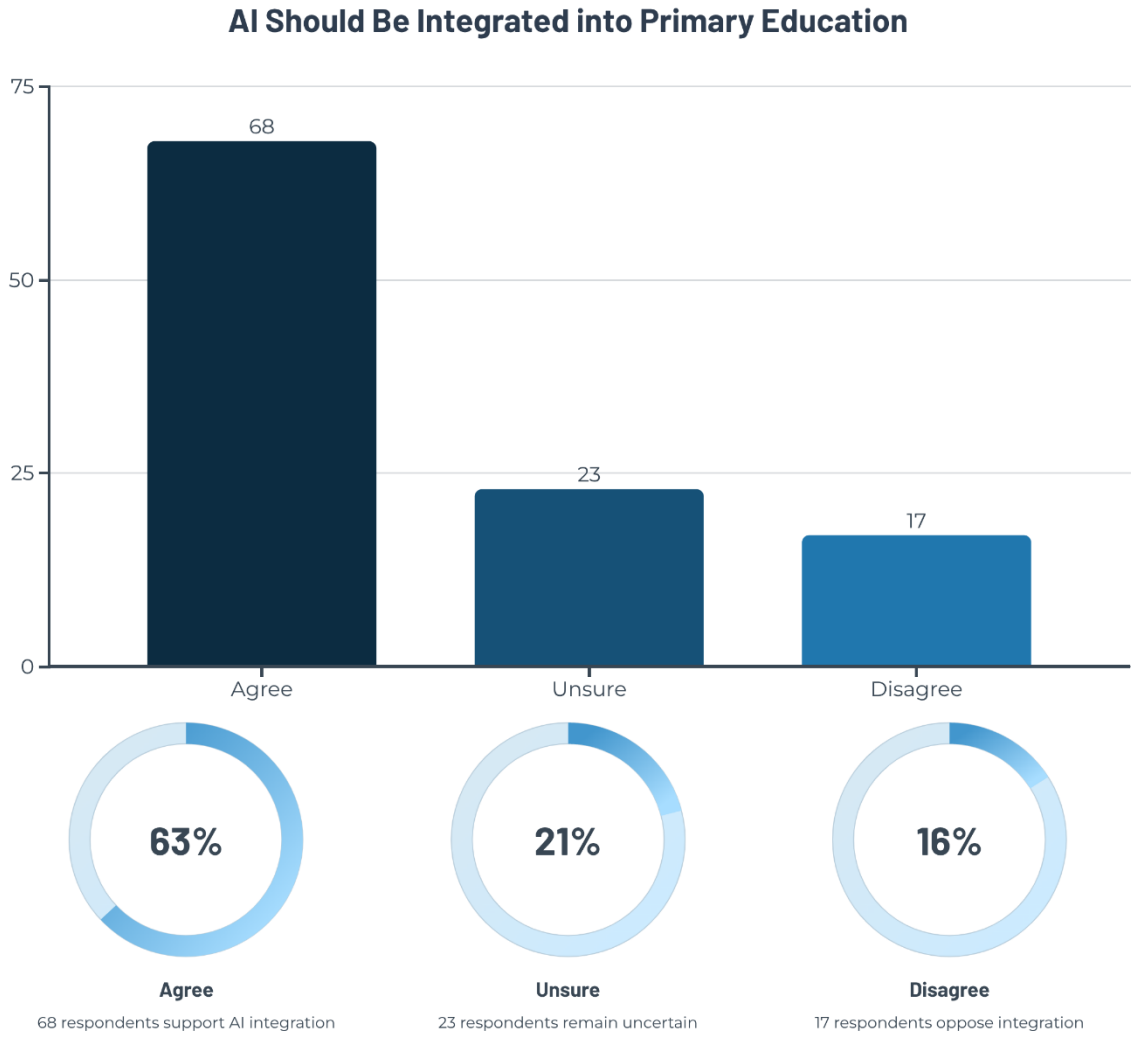


Figure 1. *Distribution of agreement with "AI should be integrated into primary education.*

The predominance of agreement in Figure 1 frames expectations about pupil engagement: if integration is valued, motivational gains are likely to be anticipated. The next step is to consider perceived effects on everyday engagement.

Expectations are, on balance, positive. Approximately half of respondents foresee improvements in pupil motivation and day-to-day engagement. The sizeable neutral segment suggests caution rather than rejection, which aligns with the emergent and context-dependent character of these tools.

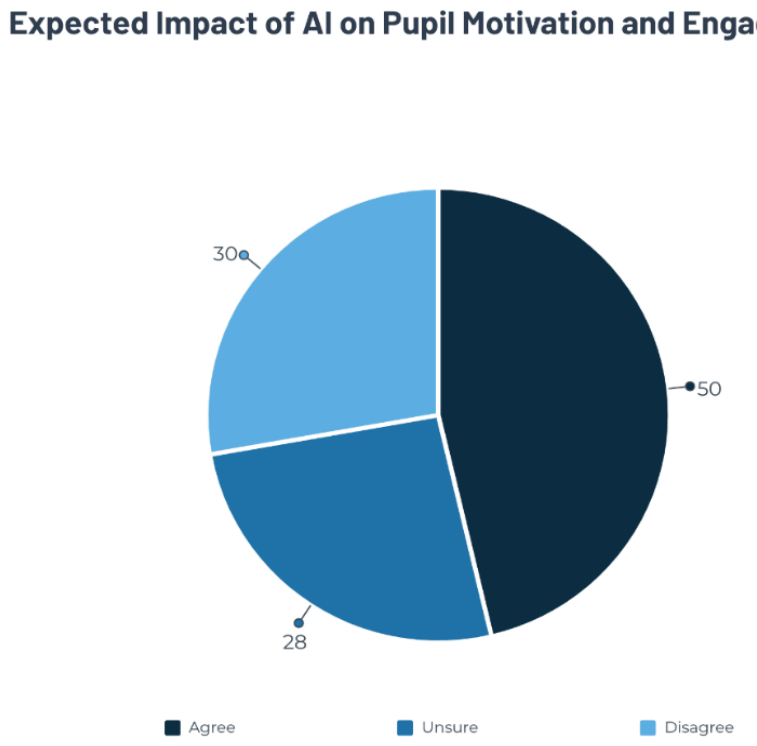


Figure 2. *Expected impact of AI on pupil motivation and engagement*

Figure 2 indicates higher expected motivation among respondents who favour integration. To probe this mechanism, we compare motivation scores across respondents with different stances on integration. Those who support integration report higher motivation scores than those who are unsure or opposed.

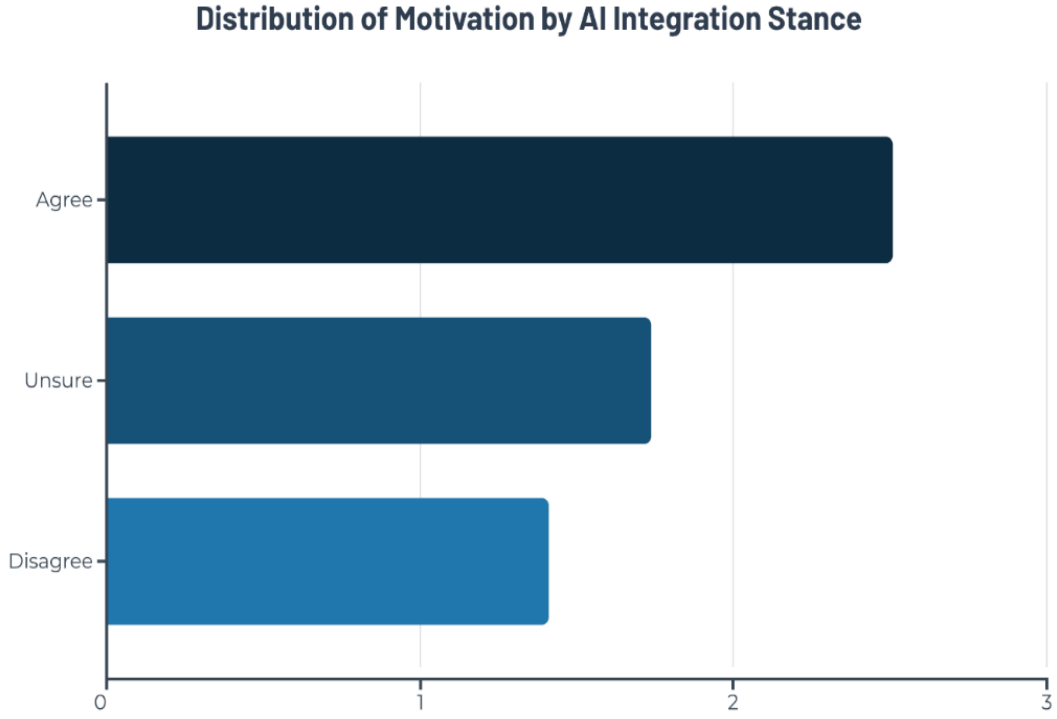


Figure 3. *Motivation scores by stance on AI integration*

The association between favourable attitudes and motivation naturally raises the question of how respondents conceptualise the role of AI relative to teacher-pupil interaction. A clear majority reject the idea that AI could replace interaction. Approximately one quarter consider replacement possible; within this subset, views diverge between likely improvement and likely deterioration in interaction quality. The dominant position treats AI as a complement rather than a substitute.

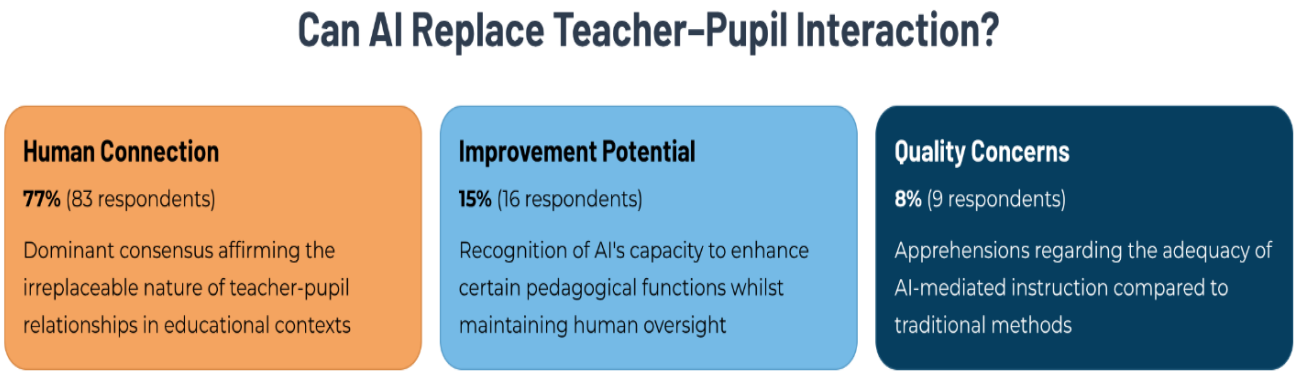


Figure 4. *Can AI replace teacher-pupil interaction?*

Seeing AI as complementary rather than substitutive aligns with expectations that it can support diverse needs without displacing core pedagogy. Just over half of respondents agree that AI can assist inclusive practice in primary classrooms, while the remainder are split between Neutral and Disagree.

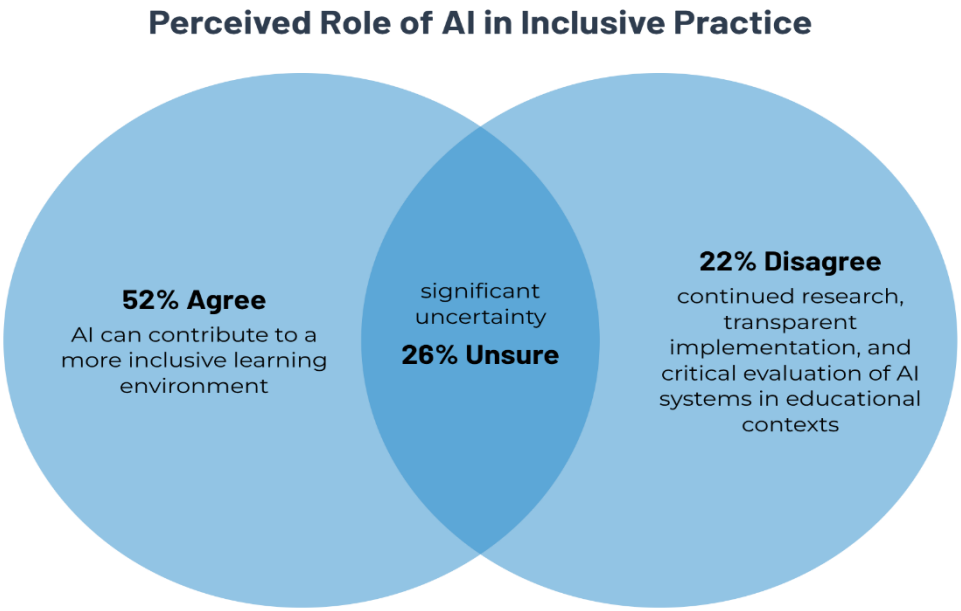


Figure 5. *Perceived role of AI in inclusive practice*

Because inclusion claims in the primary phase hinge on developmental suitability, we relate these views to confidence in judging age appropriateness. Respondents who feel confident about what is suitable for younger pupils are more likely to endorse AI for inclusion.

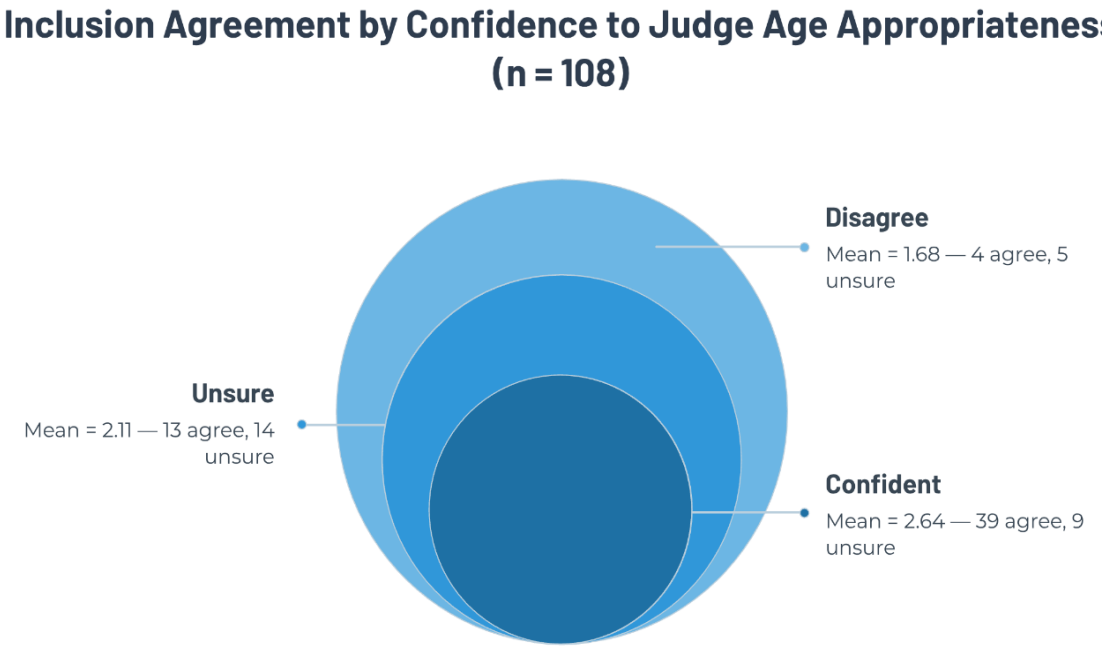


Figure 6. *Inclusion agreement by confidence to judge age appropriateness (n = 108)*

Confidence and inclusion beliefs also surface in attitudes to concrete tools. Familiarity is concentrated around ChatGPT, with 76 respondents reporting they are familiar with it. Intention to use ChatGPT is lower but substantial at 46. Awareness of other tools is modest, including adaptive practice applications and platform features such as task auto-suggestion, with branded examples like Kahoot! AI trailing behind.

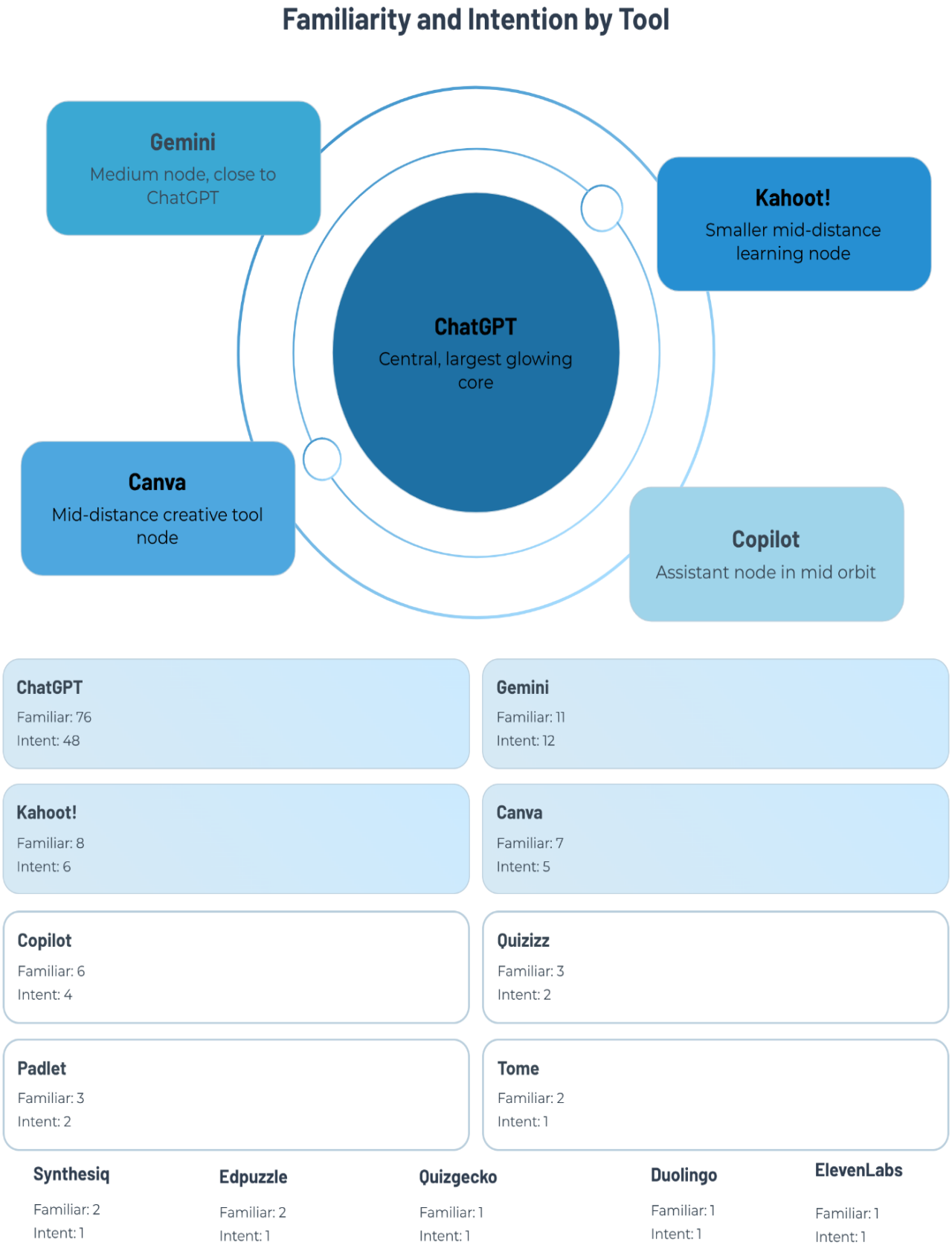


Figure 7. *Familiarity and intention by tool*

If intention reflects perceived value, it should covary with expected benefits and motivation. This trend is reflected in the data. Respondents intending to use ChatGPT report higher means for perceived learning benefits and for motivation. The difference is particularly pronounced for benefits.

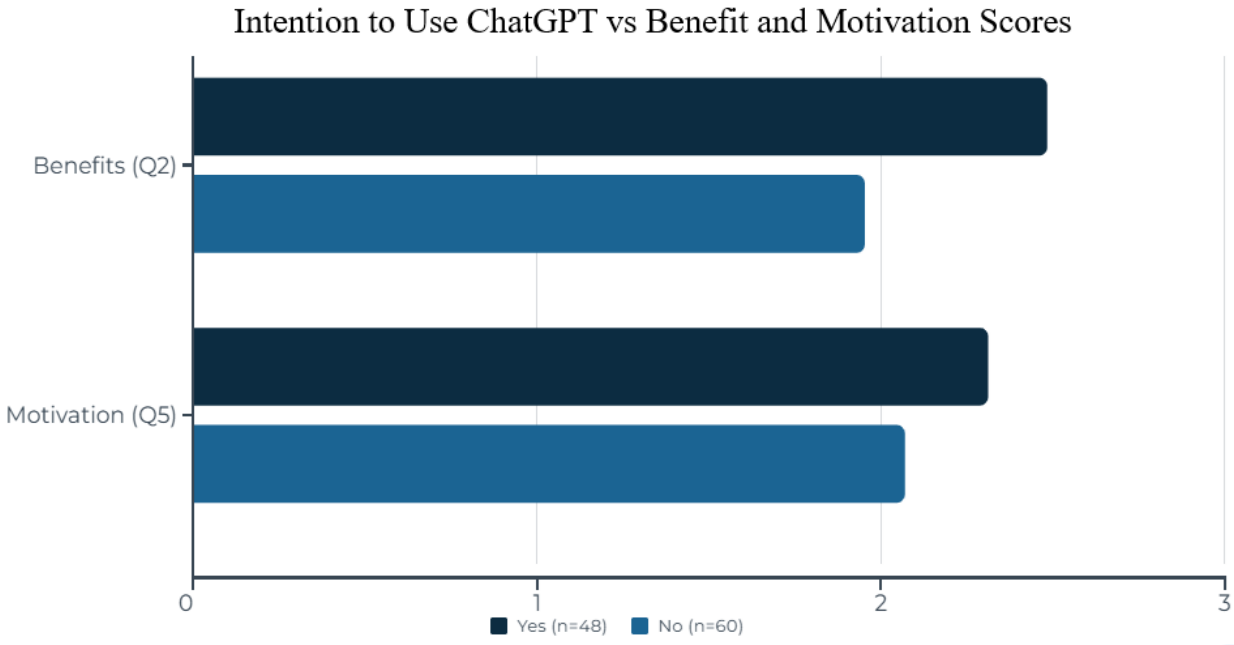


Figure 8. *Intention to use ChatGPT vs benefit and motivation scores*
Note: Scale 1–3 (1=Disagree, 2=Neutral, 3=Agree). Means derived from Q2 (Benefits) and Q5 (Motivation), grouped by intention to use ChatGPT (Q4). Total sample n=108.

Beyond intentions, the question is what respondents would actually do in class. Responses show the following order of preference. Adaptive assessment is selected most often (51 of 108), followed by AI-supported differentiated exercises (36). Instant feedback and dynamic grouping draw fewer selections at present, each with 10, which may reflect maturity of available tools or perceptions that these features are supplementary.

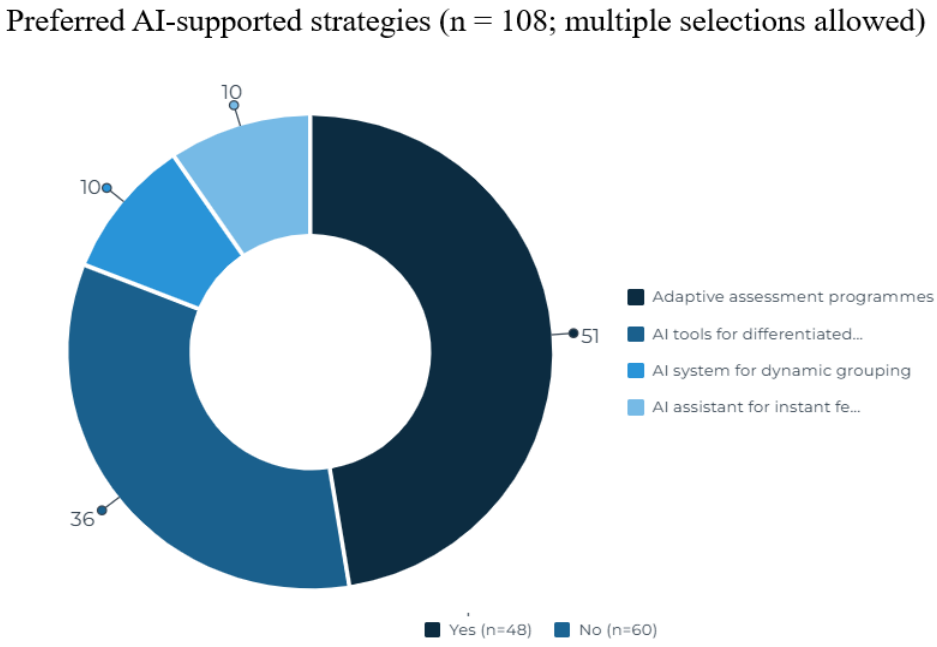


Figure 9. *Preferred strategies*

Correlations show positive relations between integration and each outcome. Spearman coefficients show that integration relates positively to expected learning benefits ($\rho \approx 0.61$), motivation ($\rho \approx 0.55$), and inclusion ($\rho \approx 0.52$). Motivation and inclusion correlate strongly with each other ($\rho \approx 0.72$), as do expected benefits and motivation ($\rho \approx 0.69$). Confidence in judging age appropriateness relates to inclusion ($\rho \approx 0.46$). Privacy awareness shows smaller yet positive links to motivation ($\rho \approx 0.38$) and study benefits ($\rho \approx 0.27$), suggesting a partially independent ethical dimension.

Table 1.
Correlation heatmap for integration, benefits, motivation, inclusion, age appropriateness, privacy

Variable	Integration	Expected benefits	Motivation	Inclusion	Age appropriateness	Privacy awareness
Integration	1.00	0.61	0.55	0.52		0.29
Expected benefits	0.61	1.00	0.69			
Motivation	0.55	0.69	1.00	0.72		
Inclusion	0.52		0.72	1.00		
Age appropriateness					1.00	0.40
Privacy awareness	0.29				0.40	1.00

Cells without values were not reported and are intentionally left blank. Diagonal fixed at 1.00. Darker blue indicates stronger positive correlation (range −1.0 to +1.0, centred at 0.0). Sample size n = 108.

Group comparisons add nuance to these associations. Respondents who intend to use ChatGPT score higher on expected benefits and on motivation. The mean for expected benefits is 2.48 among the Yes group versus 1.95 among the No group, and 2.31 versus 2.07 for motivation, which is consistent with the direction and size implied by the correlations.

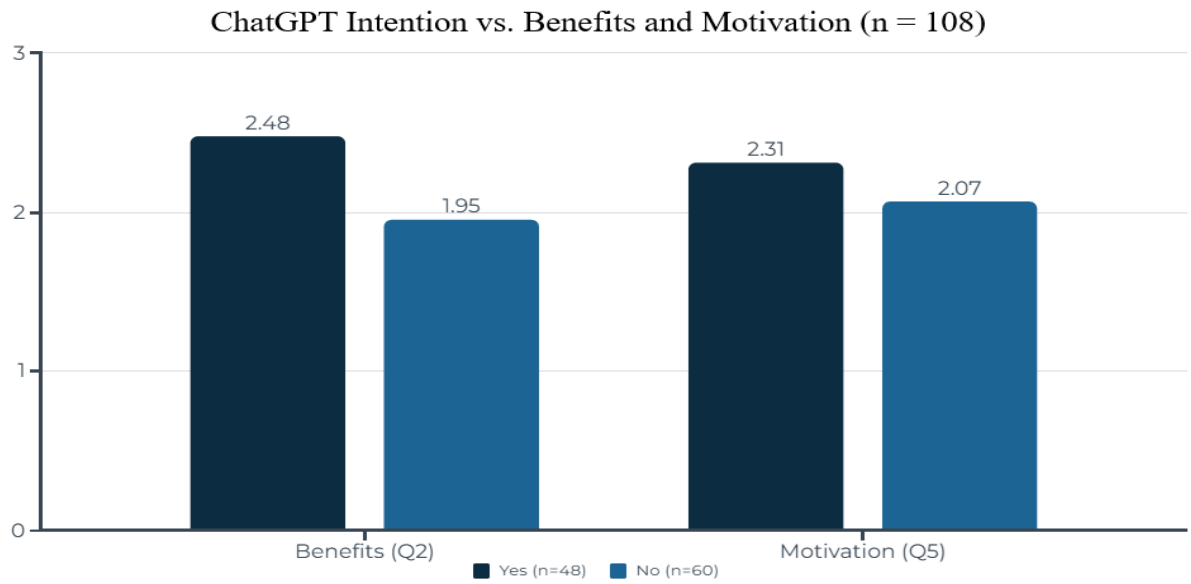


Figure 10. *ChatGPT intention vs benefits and motivation*
Scale: *1–3 (1=Disagree, 2=Neutral, 3=Agree). Yes: n=48; No: n=60; total n=108. The grouped bar chart displays mean scores for each metric by intention group.*

Views about replacement further differentiate pedagogical profiles. Those who believe replacement could improve interaction report the highest means across motivation, inclusion, age appropriateness confidence, and privacy awareness. Those who believe replacement would decrease interaction show

the lowest means, while respondents who reject replacement altogether fall between these extremes. Error bars express variability and allow visual appraisal of separation between stances.

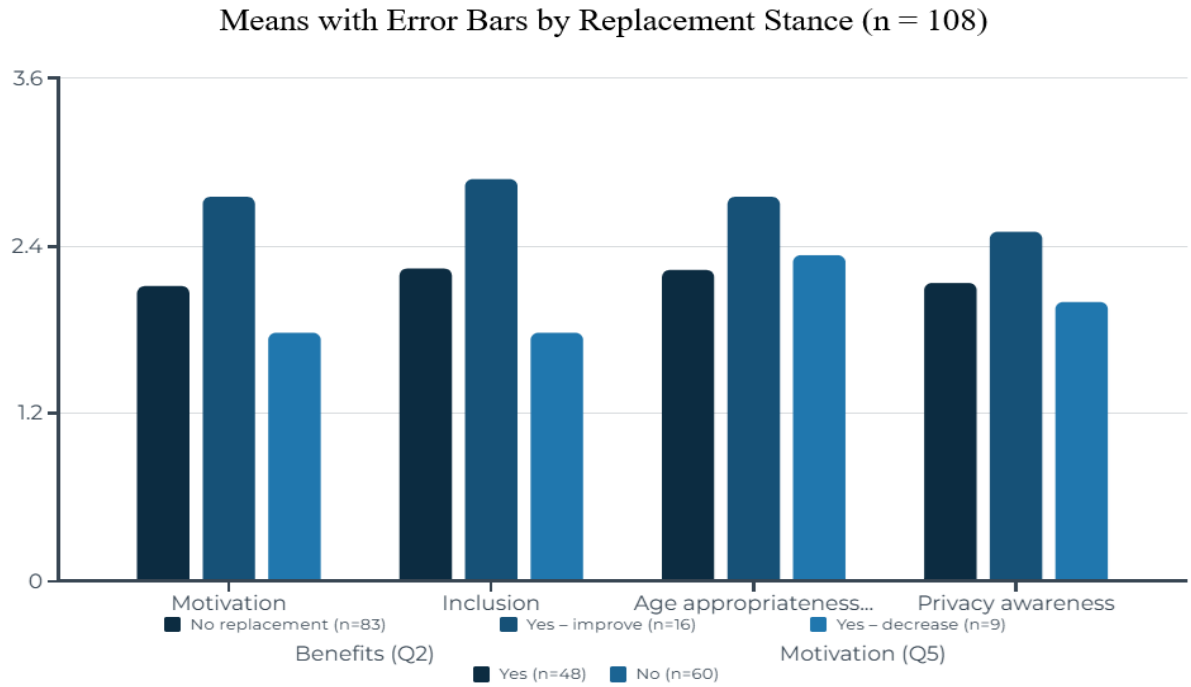


Figure 11. *Means with error bars by replacement stance*

Short free-text responses contextualise the numbers. Arguments for use highlight planning support, easier differentiation, and faster feedback, with specific examples such as tailored practice for early readers and scaffolded steps in mathematics. Concerns centre on accuracy, bias, and privacy, alongside requests for clear classroom rules, age-appropriate exemplars, and guidance on when to shift from tool output to teacher explanation. Expectations emphasise hands-on training and policy clarity regarding assessment.

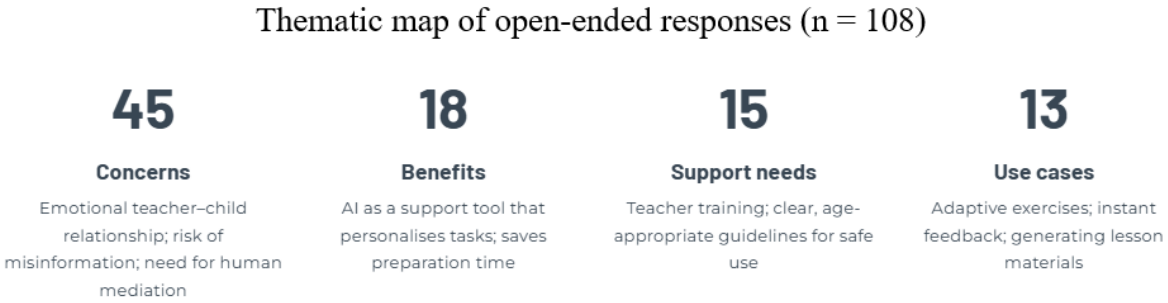


Figure 12. *Thematic map of open-ended responses (benefits, concerns, use cases, support needs)*

Unless noted otherwise, scales span 1 to 3, bar charts display means, and error bars represent one standard deviation. For 95 per cent confidence intervals, the conventional expression Mean ± 1.96 × SD ÷ √n is used. In the correlation matrix, the diagonal is fixed at 1.00 and only positive coefficients are reported; empty cells are intentionally left blank. For multiple-response strategy items, counts are reported as raw selections, with one respondent selecting none.

In aggregate, support for integration aligns with higher expected motivation and inclusion. Endorsement of integration co-varies with expectations for motivation and inclusion, a preference for complementarity over replacement, and selective readiness to adopt specific tools. The strongest associations link motivation, inclusion, and anticipated benefits, while privacy emerges as a related but comparatively weaker dimension.

Discussion

The findings point to broad support for bringing AI into primary classrooms, not as a stand-alone solution, as an aid that fits teaching goals. This matches the literature which keeps the teacher at the centre and treats tools as supports for planning, explanation, feedback and differentiation (Boulhrir & Hamash, 2025; Brito & Martínez, 2024; Abualrob, 2025; Lee & Song, 2024; Mosher et al., 2024). The clear rejection of replacement and preference for complement is consistent with research on early years, where learning relies on close guidance, clear routines and age-appropriate materials (Walan, 2024; Johnston et al., 2024). Our data also connect positive views on integration with expectations for stronger motivation and more targeted help, which echoes lesson-level reports of better engagement when teachers use tools to vary tasks and pace work for different pupils (Brito & Martínez, 2024; Abualrob, 2025; Yilmaz & Arslan, 2025).

A central theme is the gap between favourable attitudes and limited familiarity. Many students know one general chatbot, while awareness of other categories such as adaptive practice, reading supports or assessment aids is lower. Prior studies report a similar pattern: intention to use depends on perceived usefulness, ease of use and self-efficacy, yet hands-on experience is uneven and ethical questions remain (Su & Yim, 2023; Blas et al., 2024; Iglesias et al., 2025; Sanusi et al., 2024). Our results fit this view. Higher confidence about what is suitable for young pupils and better understanding of privacy go together with stronger beliefs in inclusion and learning benefits, which suggests that judgment about age fit and data use is a gateway to meaningful classroom adoption (Yilmaz & Arslan, 2025; Cukurova et al., 2024). This also resonates with work on teacher identity in the AI era, where competence grows when students move from generic enthusiasm to specific classroom routines and reflect on risks and limits (Guan, Zhang, & Gu, 2025; Martínez-Moreno & Petko, 2024; Zhang & Xu, 2025).

The results highlight several areas for improvement in teacher training programmes. First, training should be anchored in authentic primary tasks rather than generic demos. Designing tiered practice for early reading and maths, preparing question progressions, or drafting feedback that a teacher checks and personalises are practical routes that build confidence and show clear value for pupils. Interventions of this kind have been shown to lift self-efficacy and improve judgment (Otter & Tondeur, 2025; Duan & Zhao, 2024; Kai & Cheng, 2025; van den Berg & du Plessis, 2025). Second, programmes should teach selection and evaluation, not only operation. Students need simple routines to check factual quality, linguistic simplicity, cultural fairness and age fit, and to decide when to use a tool and when to switch to a hands-on activity or teacher-led explanation (Johnston et al., 2024; Boulhrir & Hamash, 2025). Third, the tool set should be broadened beyond a single chatbot. Comparative sessions that show when a lightweight aid is enough and when a richer system is worth the setup can turn positive attitudes into informed choices. Fourth, privacy and transparency should be built into planning. Students should practise disclosing tool use in plain language, avoiding identifiable pupil data, and choosing institution-approved options where possible, which mirrors current guidance for responsible adoption (Cukurova et al., 2024; Mosher et al., 2024).

Ethical and pedagogical considerations are strongest in primary years. The teacher's voice should guide every step, since young children rely on clear instructions, short texts and concrete examples. Any content produced with a tool must be checked for accuracy and bias, simplified for comprehension and linked to active work with materials. Inclusion requires varying difficulty, modality and pacing, but suggestions still need to match individual needs and plans for support. Assessment should remain fair and transparent so that process and understanding are visible even when tools help with practice or feedback. Taken together, the results suggest a practical path forward. Students are open to using AI in primary settings, yet they ask for clear, classroom-ready methods and safeguards. Programmes that embed authentic tasks, routine checks for suitability and privacy, and a wider tool repertoire can close the gap between attitude and practice and help new teachers use AI in ways that are safe, age-appropriate and firmly tied to learning aims (Kazmaci & Yildirim, 2025; Sanusi et al., 2024; Brito & Martínez, 2024; Abualrob, 2025).

Conclusion

This study shows clear support among student teachers for bringing AI into primary classrooms, with a firm line against replacing teacher-pupil interaction. Respondents link integration with higher

motivation and better targeted help, yet familiarity clusters around a single chatbot and confidence varies, especially on age suitability and privacy. These findings suggest: AI can be useful when it serves the lesson and the learner, not when it tries to stand in for the teacher.

Teacher-education programmes should turn interest into safe, purposeful practice. Priorities include authentic, curriculum-tied tasks; a wider tool repertoire beyond chatbots; simple routines for checking accuracy, readability, bias and age fit; and privacy by design. Micro-teaching, supervised placements and clear assessment policies can help new teachers use these tools with care and effect. Future work should follow cohorts into classrooms, test concrete interventions at scale, compare contexts, and track learning and inclusion outcomes. Research that involves pupils and parents, and that looks beyond general chatbots to task-specific tools, will give the field the practical evidence it needs.

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Spatial Suitability in Special Education Schools: The Case of Samsun Province in The Context of Universal Design Principles

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Abstract

This study examines the physical environments of special education institutions in Samsun, Türkiye, through the lens of universal design principles, with the aim of providing a comprehensive understanding of how accessibility and inclusivity are implemented within these educational settings. The increasing emphasis on accessibility in national policies, spatial transformation projects, and inclusive education action plans initiated by the Ministry of National Education underscores the need to evaluate the current physical conditions of special education schools. The research sample included six special education schools and one general education school with a special education classroom, all located in the central district of Samsun and serving students diagnosed with intellectual disabilities and autism spectrum disorders. Data were analyzed using frequency and percentage distributions, and the reliability of the evaluation process was strengthened through the participation of independent pre-service special education teachers as observers. Each of the 65 items in the evaluation tool was independently rated by five observers, and Krippendorff's Alpha coefficients above .80 indicated a high level of inter-observer agreement. Findings indicated that while classroom and indoor accessibility features were largely adequate and consistent with universal design principles, shortcomings persisted in restroom accessibility, emergency exits, and physical access infrastructure, with garden-related features rated as moderately satisfactory. Overall, the results suggest that although some aspects of universal design have been successfully integrated, accessibility in special education schools remains partial and uneven. The findings emphasize that physical accessibility and inclusive design should be considered as integral components of a comprehensive architectural and educational policy framework, rather than as isolated improvements, highlighting the need for systematic monitoring and policy-driven interventions to achieve genuinely inclusive and universally designed educational environments in Türkiye.

Keywords: Universal design, accessibility, special education schools, descriptive survey model.

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Introduction

Universal design is a design philosophy that seeks to ensure that all products, structures, and environments are accessible, usable, and understandable by everyone to the greatest extent possible, regardless of age, ability, or physical and cognitive differences (Mace et al., 1991). Originating in the 1980s through the work of architect Ronald L. Mace, the concept emphasizes the creation of designs that enable all individuals to benefit independently and equitably, without the need for special adaptations or additional accommodations (Rose, 2000). As a comprehensive and inclusive framework, universal design can be applied across diverse domains, including physical spaces, technological systems, and information environments (Mace et al., 1991; Maisel & Steinfeld, 2012).

Universal design represents an inclusive framework that enables individuals with diverse abilities and needs to participate equally and independently in all aspects of social life (Connell et al., 1997; Steinfeld & Maisel, 2012). It emphasizes the creation of physical, digital, and social environments that are accessible, functional, and uphold the dignity of all individuals, particularly those with disabilities (Story et al., 1998). Historically, the needs of individuals with disabilities were often addressed at the end of the design process through reactive "adaptation" or "add-on" measures; in contrast, universal design integrates these needs from the outset, thereby reducing discrimination and promoting social participation (Burgstahler, 2015; Edyburn, 2010). Examples such as ramps, auditory guidance systems, scalable digital interfaces, and simplified information texts illustrate how universal design benefits not only people with disabilities but also older adults, young children, and individuals experiencing temporary limitations (Mace et al., 1991; World Health Organization & World Bank, 2011). Ultimately, universal design contributes to a more equitable, accessible, and inclusive society by enhancing autonomy, self-esteem, and quality of life for individuals with disabilities (Imrie, 2012; United Nations, 2006).

Universal design, as a framework that promotes the equal participation of individuals with disabilities in all aspects of social life, holds particular significance within educational contexts (Steinfeld & Maisel, 2012; Burgstahler, 2015). In this regard, designing schools in accordance with universal design principles not only guarantees physical accessibility but also fosters environments where all students, teachers, and staff can engage in the educational process independently and with dignity (Imrie, 2012; Connell et al., 1997). Whereas traditional architectural approaches have often addressed accessibility needs reactively by adding ramps or elevators after construction, universal design proactively integrates such features into the initial planning stage, thereby reducing barriers and preventing discrimination from the outset (Mace et al., 1991).

Educational environments extend beyond physical structures to include access to information, materials, social relationships, and learning experiences. Accordingly, universal design principles advocate for the inclusive planning of every aspect of the school environment, from classroom layout and signage to outdoor spaces and restrooms, ensuring equitable participation for all (Story et al., 1998; World Health Organization & World Bank, 2011). Through such inclusive design, students gain not only physical access to spaces but also meaningful opportunities to engage in active learning, build peer relationships, and express themselves (United Nations, 2006; Turgut, 2016). Designing schools in line with universal design principles addresses the needs of a broad and diverse population, including not only students with disabilities but also those with temporary health conditions (e.g., a student with a broken leg), young children, learners from different linguistic backgrounds, and older teachers (Edyburn, 2010; Steinfeld & Maisel, 2012). In this way, the right to education can be realized equitably and inclusively, regardless of individual differences.

Literature Review

Kaplan and Aksoy (2019) evaluated the physical conditions of special education institutions in Eskişehir Province within the framework of universal design principles. Using observations and checklists, they examined the architectural structures, accessibility levels, and user suitability of 11 special education institutions. The findings revealed significant accessibility deficiencies across most of the evaluated schools. In particular, noncompliance with universal design principles was identified in fundamental access elements, including ramps, elevators, signage, restrooms, and door widths. Moreover, the study found that most institutions lacked arrangements to facilitate the independent mobility of individuals

with disabilities. Kaplan and Aksoy emphasized that such deficiencies could negatively affect user satisfaction and participation in education, concluding that the principles of universal design should be more systematically integrated into educational architecture.

The findings of Kaplan and Aksoy (2019) suggest that universal design principles are not consistently incorporated into the physical environment planning of special education institutions. This limitation may negatively impact the educational experiences of individuals with disabilities. Conducting similar studies across different geographical regions would contribute to a more comprehensive understanding of the scope and quality of universal design implementation throughout Türkiye. Moreover, given the Ministry of National Education's recent accessibility policies, spatial transformation projects, and national action plans for inclusive education, a renewed assessment of existing conditions has become increasingly necessary. In response to these needs, the present study aims to examine the physical conditions of special education institutions in Samsun Province through the lens of universal design principles.

Method

This section presents details about the research design, participants, data collection instrument, data collection procedures, and data analysis methods.

Research Design

This study was conducted within the scope of the descriptive survey model, a type of quantitative research design. The descriptive survey model is a research design that aims to reveal the specific characteristics of individuals, objects, or events as they are. The goal of the descriptive survey model is to draw a general conclusion about the current state of affairs based on the data collected (Karasar, 2022).

Participants

For the study, the authors compiled a list of official special education schools and general education schools with special education classes located in the central district of Samsun province using open-access internet resources. In this context, a total of 15 institutions were reached. As a result of interviews conducted with the institution authorities, six special education schools and a general education school with a special education classroom that volunteered to participate were included in the research sample. It was determined that all institutions examined were established as educational institutions. These schools included in the study provide academic services to students diagnosed with intellectual disabilities and autism spectrum disorders. Descriptive findings regarding the number of classrooms, teachers, administrators, and children with special needs in the schools are presented in Table 1.

Table 1.
Descriptive Statistics of the Special Education Schools Included in the Study.

Variable	$\bar{X}$	SD	Range
Number of Classrooms	12.89	8.87	2-30
Number of Teachers	31.24	22.57	4-74
Number of Administrators	2.93	0.25	2-3
Number of SwD	68.71	48.01	14-166

SwD = Students with Ddisabilities; SD = : Standard deviation

Data Collection Instrument

The Universal Design Checklist developed by Kaplan and Aksoy (2019) was employed as the data collection instrument in this study. The checklist comprises 65 items organized into six subdimensions: classroom-related features, indoor access elements, physical access elements, garden features, toilets, emergency exits, and emergency procedures. Each item is rated on a binary scale, with "1" indicating adequacy and "0" indicating inadequacy, yielding a maximum total score of 65. The total score represents the degree to which the evaluated physical environment aligns with universal design

principles; higher scores indicate greater alignment with these principles. Additionally, demographic information, including the purpose of the building, the number of students, teachers, administrators, and classrooms, was collected from each participating institution.

Data Collection and Analysis

After the institution representatives, who agreed to participate in the study within the scope of the research, signed the Voluntary Participation Form, the physical conditions of the institutions were evaluated based on the "Universal Design Checklist." Data was collected systematically by assigning a score of '1' if the conditions were met for each item on the checklist and '0' if they were not.

The collected data were analyzed using frequency (f) and percentage (%) distributions. Findings were reported in two dimensions: the number of institutions meeting each checklist item and the total scores obtained by each institution. During the analysis, items corresponding to each subdimension were identified, and all related observations were aggregated. The arithmetic mean of these data was then calculated to determine the overall adequacy level for each subdimension, and the resulting value was expressed as a percentage.

To enhance the reliability of the research, four senior pre-service special education teachers, who were independent of the research team, participated in the data collection process as observers. In each school, five different observers independently evaluated the same 65 items. Krippendorff's Alpha coefficient was computed to assess inter-observer agreement, and the coefficients were reported separately for both the overall scale and each subdimension. The corresponding reliability values are presented in Table 2.

Table 2.
Interobserver Reliability Coefficients for the Subdimensions of the Universal Design Checklist.

Subdimension	Krippendorff's Alpha (α)	SE	%95 CI
Classroom-Related Features	.920	.058	[.781, 1.000]
Indoor Access Elements	.982	.013	[.951, 1.000]
Physical Accessibility Features	.967	.015	[.933, .994]
Garden Features	.891	.047	[.787, .974]
Toilet Features	.911	.027	[.856, .956]
Emergency Exits and Emergency Preparedness Features	.989	.011	[.964, 1.000]

SE = Standart error, CI = Confidence interval.

An examination of the findings presented in Table 2 indicates that the Krippendorff's Alpha coefficients for all subdimensions meet or exceed the accepted threshold of .80. The overall alpha coefficient encompassing all subdimensions was also found to be notably high (α = .956, 95% CI [.940, .972]). According to Krippendorff (2011), alpha values of .80 or higher are considered sufficient for reliable interpretation in inter-rater agreement analyses. Accordingly, these results demonstrate a high level of consistency among observers in the evaluation of universal design elements.

Findings

This study assessed the extent to which seven schools affiliated with the Ministry of National Education in Samsun Province adhere to universal design principles. The evaluation was conducted using a 65-item *Universal Design Checklist*, with each school independently assessed by five observers. Data were analyzed across six subdimensions: (a) classroom-related characteristics, (b) interior access elements, (c) physical accessibility features, (d) garden characteristics, (e) toilet accessibility, and (f) emergency exits and emergency preparedness.

Overall Adequacy Rates of Schools by Sub-Dimensions

This section addresses the overall adequacy levels related to the sub-dimensions included in the Universal Design Checklist. Calculated based on the arithmetic means of the scores given by observers, these rates systematically reveal the areas in which schools are more or less adequate in terms of physical accessibility. The findings presented below reflect general trends in accessibility at the sub-dimension level and highlight priority areas that require intervention. Overall adequacy rates for sub-dimensions

were calculated by taking the arithmetic mean of the scores given by observers. The findings are presented in Table 3.

An examination of the findings in Table 3 reveals that the *Classroom-Related Features* subdimension demonstrated the highest level of adequacy, with an average score of 89.11%. Similarly, a high adequacy rate was observed in the *Interior Access Elements* subdimension (89.12%). The *Garden Features* subdimension showed an adequacy rate of 77.46%, which can be considered acceptable. In contrast, the *Physical Accessibility* subdimension yielded an average adequacy rate of 63.75%, reflecting a limited level of accessibility. The *Emergency Exits and Emergency Preparedness* subdimension exhibited a moderate level of accessibility, with a competence rate of 58.06%. Conversely, the *Toilet Accessibility* subdimension presented the lowest adequacy level, with a rate of 47.11%.

Table 3.
Minimum, Maximum, and Average Adequacy Values According to Subdimensions in the Universal Design Checklist.

Sub-dimension	Min (%)	Max (%)	Mean (%)
Classroom-Related Features	60	100	89.11
Indoor Access Elements	71.43	98.57	89.12
Physical Accessibility Features	28.57	100	77.46
Garden Features	0	93.75	63.75
Toilet Features	25	75	58.06
Emergency Exits and Emergency Preparedness Features	22	78	47.11

The findings indicate that special education institutions have made positive strides in adapting classroom arrangements and physical environments to enhance accessibility for students. However, several physical components, such as garden areas, emergency exit signage, barrier-free passageways, and floor level transitions, require redesign. Moreover, it is a pressing necessity that school buildings comply with current accessibility standards, including features such as accessible toilets, grab bars, automatic doors, and adequately spacious interior areas. Addressing existing deficiencies in physical accessibility requires effective coordination among provincial and district special education services boards, as well as the units responsible for construction and maintenance.

Items with the Lowest and Highest Scores by Sub-Dimension

Analyses based on sub-dimensions provide detailed insights into the physical accessibility levels of special education schools, examining various structural components. In this context, the aim is to identify the strengths of current practices and areas for improvement by focusing on the items with the highest and lowest levels of compliance in each sub-dimension of the Universal Design Checklist. The findings indicate that some basic principles of accessibility are met at a high level; however, limitations exist in critical elements, including sensory cues, guidance systems, hardware diversity, and inclusive use. The findings are presented in Tables 4 through 9.

Table 4.
Descriptive Characteristics Related to the Sub-Dimension of Classroom-Related Features.

Item Content	f	%
1. The floor should be hard, smooth, and slip-resistant.	40	88.9
2. The floor should contrast with the walls.	40	88.9
3. Each classroom should provide 1.5 m² of usable space per student.	34	75.6
4. Windows should be located on the outer façade of the building and allow natural ventilation.	42	93.3
5. Windows should pose minimal risk when opened.	37	82.2
6. Handles that require minimal force to operate should be used (windows).	37	82.2
7. Each door should have a minimum width of 80 cm.	43	95.6
8. Doors should either open outward or be designed as sliding doors.	39	86.7

9. Classroom doors should not have thresholds.	45	100.0
10. Handles that require minimal force to operate should be used (doors).	39	86.7

Note. *Percentages reflect the arithmetic mean of five independent observations.*

According to the findings presented in Table 4, the item with the highest compliance rate was *"There should be no thresholds on classroom doors,"* which was met in all institutions (100%, *f* = 45). The criterion requiring a minimum door width of 80 cm was satisfied in 95.6% of cases (*f* = 43), while the requirement that classroom windows be positioned on the exterior walls of the building to allow natural ventilation was met in 93.3% of cases (*f* = 42).

Conversely, the item stating that *"Classrooms should have 1.5 m² of usable space per student"* exhibited the lowest compliance rate at 75.6% (*f* = 34). However, the requirements concerning *"handles requiring minimum force to operate"* on windows and doors were met at rates of 82.2% (*f* = 37) and 86.7% (*f* = 39), respectively. These findings suggest that classroom design, particularly with respect to door and window hardware and access widths, is largely consistent with universal design principles; nevertheless, there remains room for improvement in the allocation of individual workspace and certain hardware details.

Table 5.
Descriptive Statistics for the Interior Access Elements Subdimension.

Item Content	f	%
1. Stairways should be wide enough to allow students to ascend and descend simultaneously.	35	77,8
2. The edges of the steps should be clearly marked.	35	77,8
3. Tactile warning indicators should be installed at the top and bottom of stairways.	15	33,3
4. Stairways should have a minimum width of 1.2 meters.	35	77,8
5. Stairways should have handrails on both sides.	23	51,1
6. Handrails should extend continuously through intermediate landings.	23	51,1
7. A central handrail should be installed when the stairway width exceeds 2 meters.	28	62,2
8. Handrails should provide a clear visual contrast with the floor surface.	30	66,7
9. Step edges should be illuminated to avoid shadowing.	35	77,8
10. Stairways should include no more than 12 steps.	40	88,9
11. Directional signage for emergency exits should be provided.	29	64,4
12. Ceilings should have a minimum height of 3 meters.	38	84,4
13. Corridors should be no less than 1.5 meters wide when there are fewer than two classrooms on one side, and no less than 2 meters wide when there are more than two classrooms.	39	86,7
14. When classrooms are located on both sides, corridors should have a minimum width of 2.5 meters.	33	73,3

According to the findings presented in Table 5, the interior designs of the schools are largely consistent with accessibility principles. The item stating that *"stairways should contain a maximum height of 12 steps"* exhibited the highest level of compliance at 88.9% (*f* = 40). This was followed by the item *"corridors should be at least 1.5 meters wide when there are fewer than two classrooms on one side, and at least 2 meters wide when there are more than two classrooms"* with a compliance rate of 86.7% (*f* = 39), and *"the ceiling height should be at least 3 meters"* with 84.4% (*f* = 38). Overall, these results suggest that the structural accessibility of interior spaces is generally adequate.

However, the lowest compliance rate was observed for the item stating that *"tactile warning signs should be present above and below the steps"* at 33.3% (*f* = 15). The items *"handrails should continue at intermediate landings"* and *"handrails should be present on both sides of the stairs"* demonstrated

limited compliance, with rates of 51.1% (*f* = 23). Additionally, it is noteworthy that critical guidance and safety features such as *"directional signage for emergency exits"* (64.4%, *f* = 29) and *"visual contrast between the handrails and the floor"* (66.7%, *f* = 30) were also insufficiently implemented. These findings suggest that while certain structural standards are generally met, sensory aids (e.g., tactile signs and visual contrast elements) and safety guidance systems require further development to fully align with universal design principles.

Table 6.
Descriptive Statistics for the Physical Accessibility Elements Subdimension

Item Content	f	%
1. Ramps should have a minimum width of 1.3 meters.	31	68,89
2. Handrails should provide a clear visual contrast with the floor surface.	34	75,56
3. Path surfaces should be durable and stable, allowing unobstructed movement for wheelchair users.	34	75,56
4. Emergency exit signage should be clearly provided.	23	51,11
5. Ramp edges should include curbs or protective barriers to ensure safety.	36	80
6. Handrails should be provided on both sides of the ramp and should continue along intermediate landings.	27	60
7. The elevator should be positioned within a short distance of the main lobby and activity facilities.	22	48,89
8. Elevator doors should remain open for a minimum of 8 seconds.	35	77,78
9. The floor surface should be designed to enable wheelchair users to make a 180° turn comfortably.	23	51,11
10. The elevator cabin should have minimum internal dimensions of 1.8 m × 1.8 m.	22	48,89
11. Control buttons should be positioned for universal accessibility and designed for ease of use.	30	66,67
12. A half-length mirror should be installed on the rear wall of the elevator cabin.	30	66,67
13. Visual and tactile floor indicators should be installed at every landing to support orientation.	18	40
14. Asansör sinyal sistemi hem görsel hem işitsel olmalıdır.	13	28,89
15. Handrails should be installed on walls without doors to ensure continuous support along circulation routes.	6	13,33
16. The location of the elevator should be clearly indicated from the building entrance and other major circulation points to facilitate wayfinding.	29	64,44

Table 6 indicates that while certain structural elements exhibit high levels of compliance, notable deficiencies remain in others. The item *"ramp edges or protective barriers must be present"* showed the highest compliance rate at 80% (*f* = 36), followed by *"doors must remain open for at least eight seconds"* at 77.78% (*f* = 35). Additionally, the items *"the road surface must be suitable for wheelchair movement"* and *"handrails must create a visual contrast with the floor"* both achieved compliance rates of 75.56% (*f* = 34). Overall, these findings suggest that several basic accessibility features have been adequately implemented, although room for improvement persists in ensuring comprehensive compliance.

Table 7.
Descriptive Statistics for the Garden Subdimension.

Item Content	f	%
1. Direct access to the building entrance should be ensured from all approach routes and access points.	35	77.8

2. All pathways should be designed to be accessible unless equivalent alternative routes begin and end at the same point.	42	93.3
3. Pathways should be designed to permit the circulation of emergency vehicles when necessary.	37	82.2
4. Building entrances should be clearly highlighted and emphasized through appropriate lighting.	36	80.0
5. Access routes should be designed to be intuitive, easily understandable, and user-friendly.	37	82.2
6. Ramped and stepped paths should be clearly visible, properly marked, and easily identifiable.	26	57.8
7. Color or texture variations should be incorporated to support wayfinding and environmental orientation.	12	26.7

Conversely, the items *"handrails should be present on walls without doors"* (13.33%, $f = 6$), *"the elevator signal system should be both visual and audible"* (28.89%, $f = 13$), and *"visual and tactile floor indicators should be provided at every landing"* (40%, $f = 18$) demonstrated the lowest levels of compliance. Moreover, items related to elevator dimensions (48.89%, $f = 22$), placement (48.89%, $f = 22$), and control systems were also found to be insufficiently met. These results suggest that structural accessibility remains limited, particularly for individuals with mobility impairments. Overall, while some fundamental requirements for physical accessibility have been satisfied, substantial improvements are still needed especially in elevator systems, directional signage, and design details that facilitate the independent mobility of individuals with disabilities.

According to the findings presented in Table 7, school grounds are accessible in several respects; however, deficiencies persist in areas such as signage and directional guidance. The item *"all paths should be accessible unless there are alternative paths that start and end at the same location"* demonstrated the highest compliance rate at 93.3% ($f = 42$). This was followed by the items *"the path should allow for the movement of emergency vehicles"* and *"access routes should be understandable and easy to use,"* each with a compliance rate of 82.2% ($f = 37$). Additionally, the illumination of building entrances emerged as a positive feature, meeting the relevant requirement at a rate of 80% ($f = 36$).

However, the item *"ramp and stepped paths should be clearly visible and well marked"* demonstrated a compliance rate of only 57.8% ($f = 26$), while the item *"color or texture changes should be used for wayfinding"* showed the lowest adequacy level within this subdimension at 26.7% ($f = 12$). These results point to significant shortcomings, particularly regarding visual guidance and distinctive environmental cues. Overall, the findings suggest that although school playgrounds generally provide structures that enable physical access, they remain insufficient in terms of signage and wayfinding systems that support orientation and guidance consistent with universal design principles.

Table 8

Descriptive Statistics for the Toilet Accessibility Subdimension.

Item Content	**f**	**%**
1. The toilet should be accessible and positioned in a convenient, easily reachable location.	43	95,6
2. Fixtures and fittings within the toilet should be fully accessible to all users.	38	84,4
3. An enlarged (accessible) toilet cabin should be available for users requiring additional space.	18	40
4. Sinks at varying heights should be provided to accommodate users with different physical needs.	7	15,6
5. A low-height urinal should be available.	16	35,6
6. A unisex (gender-neutral) toilet should be available to support inclusive use for all individuals.	4	8,9
7. A unisex (gender-neutral) baby changing area should be provided to ensure accessibility for all caregivers.	6	13,3
8. There should be knee space between the sink and the seating area.	36	80
9. Explanatory signage or information tables should be provided to facilitate user understanding.	28	62,2
10. Signage should include both visual and written expressions to ensure accessibility for all users.	27	60

According to the findings presented in Table 8, basic accessibility features are largely satisfied; however, deficiencies persist in hardware variety and the implementation of inclusive design principles. The item *"the toilet should be accessible and located in an easily reachable area"* demonstrated the highest compliance rate at 95.6% (*f* = 43). This was followed by the item *"toilet fixtures should be accessible"* with a compliance rate of 84.4% (*f* = 38) and *"there should be knee space between the sink and the seating area"* at 80% (*f* = 36), both of which represent other elements positively contributing to accessibility.

However, the findings related to other items suggest that toilet facilities still fail to adequately accommodate the needs of all user profiles. The item *"an extended cabin should be available"* demonstrated a compliance rate of only 40% (*f* = 18), while *"a low-height urinal should be available"* was met at a rate of 35.6% (*f* = 16). Particularly low compliance rates were also observed for inclusive design features such as *"sinks of different heights should be provided"* (15.6%, *f* = 7), *"unisex toilets should be provided"* (8.9%, *f* = 4), and *"unisex baby changing areas should be provided"* (13.3%, *f* = 6). Although signage-related features showed relatively better results, they remained limited: *"explanatory tables should be provided"* achieved a compliance rate of 62.2% (*f* = 28), and *"signs should include both visual and written expressions"* reached 60% (*f* = 27). Overall, these findings suggest that while toilets generally meet fundamental accessibility standards, additional improvements are needed to enhance flexibility, gender inclusivity, and responsiveness to diverse user needs in accordance with universal design principles.

Table 9

Descriptive Statistics for the Emergency Exits and Emergency Preparedness Subdimension.

Item Content	f	%
1. Each floor should include at least one emergency exit door.	28	62,2
2. Emergency exit doors should be operable with minimal physical effort.	28	62,2
3. Emergency exit signage should include both visual and written indicators, enhanced with lighting, and placed in clearly visible locations.	25	55,6
4. Tactile (raised) floor indicators should be installed to guide individuals toward emergency exits.	11	24,4
5. Each floor should be equipped with at least one accessible fire extinguisher.	37	82,2
6. A designated infirmary or first aid room should be present within the facility.	29	64,4
7. A generator should be available.	0	0
8. A water storage tank with a minimum capacity of 5 liters per person should be provided.	35	77,8

According to the findings in Table 9, some basic safety measures have been implemented, but guidance systems and support units in particular are inadequate. The items "Fire extinguishers must be available on every floor" and "A water tank with a minimum capacity of 5 liters per person must be available" had the highest compliance rates at 82.2% (f = 37) and 77.8% (f = 35), respectively. In addition, the clause "A medical room or first aid unit must be available" was met at a rate of 64.4% (f = 29), while the clauses "There must be an emergency exit door on each floor" and "Minimum force must be required to open the emergency exit door" were met at an equal rate of 64.4% (f = 28).

However, the data on signage systems indicate that significant improvements are needed in this area. Only 55.6% (*f* = 25) of institutions met the requirement that *"emergency exit signs should be visually and verbally highlighted with lighting and positioned at prominent points." In comparison,* just 24.4% (*f* = 11) complied with the criterion that *"raised path indicators should be used for emergency exits."* Notably, the requirement that *"a generator should be available"* was not met in any institution (*f* = 0), representing a significant shortcoming in terms of emergency preparedness. Overall, while physical safety measures such as fire protection systems and basic first aid facilities were present in many institutions, guidance systems and alternative power sources remained insufficient. These findings suggest that emergency preparedness should be approached comprehensively and integrated into broader universal design planning.

Discussion, Conclusion, and Suggestions

This study aimed to determine the extent to which the physical conditions of special education institutions in Samsun Province align with the principles of universal design. The findings revealed that these institutions are highly adequate in classroom-related features and indoor accessibility elements, adequate in garden-related features, and moderately adequate in physical accessibility, emergency exits, and emergency preparedness components. However, the results also indicate that toilet facilities represent the most inadequate aspect of the physical environment in special education institutions.

The finding that the *Classroom Features* subdimension demonstrated an adequacy rate of 89.11% indicates that special education institutions essentially prioritize organizing classroom environments in accordance with universal design principles. This high level of compliance suggests that spatial solutions reflecting principles such as *equitable use*, *flexibility in use*, and *intuitive use* have been effectively implemented in classroom settings (Kozleski & Waitoller, 2010). For instance, wide passageways, movable furniture, and flexible arrangements that accommodate diverse learning needs enable all students to participate equally in classroom activities. In this regard, the functionality and accessibility of classroom environments not only facilitate learning processes but also foster students' independence and sense of belonging.

A high adequacy rate of 89.12% was also achieved in the *Indoor Access Features* subdimension. This finding suggests that movement within the buildings is largely unobstructed, allowing individuals to independently perform essential actions, such as orienting themselves, reaching, and accessing spaces. Design elements such as wide corridors, ramps, handrails, and directional signage incorporating sensory cues facilitate both physical and cognitive accessibility, reflecting the universal design principles of *low physical effort* and *perceptible information* (Story et al., 1998). In this context, careful attention to the spatial layout of interior environments enables users to navigate safely and independently, thereby fulfilling the fundamental requirements of an inclusive educational environment.

In contrast, the finding that the *Garden Features* subdimension achieved an adequacy rate of only 77.46% indicates that outdoor spaces are less accessible than classrooms and indoor areas. However, playgrounds, green spaces, and outdoor activities play a vital role in supporting the social, emotional, and physical development of individuals with disabilities (Green Schoolyards America, 2021). A garden designed in accordance with universal design principles should incorporate elements such as accessible surfaces for children with varying mobility levels, wheelchair-accessible pathways, sensory play materials, and quiet zones. Such arrangements not only enhance physical accessibility but also promote social inclusion. Therefore, although the current adequacy rate is acceptable, the findings highlight the need for a more comprehensive application of universal design principles in outdoor environments.

The adequacy rate of 63.75% for the *Physical Accessibility Features* subdimension indicates a relatively limited level of accessibility. This finding suggests that building entrances, door widths, ramps, elevators, and overall architectural layouts exhibit notable shortcomings in meeting universal design standards. In particular, the presence of stepped entrances, narrow corridors, and stairways as the sole means of access can hinder individuals with mobility impairments from entering school buildings independently (Imrie, 2012). In line with the universal design principle of *size and space for approach and use*, all individuals should be able to access spaces under equal conditions. Accordingly, these limitations in physical accessibility demonstrate that universal design principles have not yet been fully integrated into the architectural planning of schools, identifying this as a critical area for improvement.

The adequacy rate of 58.06% for the *Emergency Exits and Emergency Preparedness* subdimension highlights significant safety concerns. Universal design encompasses not only everyday accessibility but also provisions for emergencies. In particular, the use of both audible and visual alarm systems is essential to ensure that individuals with hearing or visual impairments can be safely evacuated. Moreover, emergency exit routes should be accessible to individuals using wheelchairs, and evacuation plans should be presented in formats understandable to all (Steinfeld & Maisel, 2012). Although this level of compliance indicates that some fundamental safety measures are in place, it also underscores that inclusive emergency planning has not yet been fully realized. Importantly, universal design aims to ensure equal protection for everyone, even in extraordinary circumstances.

The lowest adequacy rate identified in the study was in the *Toilet Accessibility Features* subdimension, at 47.11%. This finding suggests that personal care and hygiene, among the most fundamental human needs, are not sufficiently considered in the design of existing facilities. Yet toilet areas hold critical importance both physically and in terms of privacy, aligning with the universal design principles of *equitable use* and *simple and intuitive use* (Webber, 2020). Design elements such as stall width, door orientation, grab bars, and sink height constitute the core components of accessible restroom design. These deficiencies not only impede individuals' independent use but also limit their full participation in the educational process. The low adequacy rate, therefore, underscores the urgent need for comprehensive redesign in this area.

In addition to these key findings, the study has several limitations. First, because the research was conducted exclusively in special education institutions within Samsun Province, the generalizability of the findings to other regions of Türkiye is limited. The relatively narrow institutional scope may also have prevented adequate representation of different types of special education settings (e.g., rehabilitation centers). Moreover, the instruments used in the data collection process focused solely on physical accessibility, excluding the cognitive, sensory, and experiential dimensions of universal design and thereby limiting the comprehensiveness of the evaluation. The absence of user perspectives, such as those of students, teachers, and parents, further restricted the availability of experiential data. Finally, the interpretation of universal design principles and the selection of evaluation criteria primarily emphasized the technical aspects of accessibility, potentially overlooking a broader and more holistic understanding of inclusivity. These limitations should be considered when interpreting the study's results.

Drawing on the findings and limitations of this study, several recommendations can be made for future research and practical implementation. First, future studies should investigate universal design approaches that address not only physical accessibility but also cognitive, sensory, and social accessibility, incorporating user experiences into the evaluation process. Second, comparative studies conducted across different regions and types of institutions may help identify spatial inequalities and highlight exemplary practices. Third, at the policy level, universal design principles should be comprehensively integrated into existing building regulations, and accessibility assessments should prioritize inclusiveness and ease of use over solely focusing on legal compliance. Centralized model projects, design guidelines, and improvement frameworks, particularly for areas such as toilets and emergency exits, should be developed, with active participation from special education professionals and other relevant stakeholders. Finally, schools should conduct regular accessibility audits, establish continuous improvement mechanisms based on user feedback, and provide in-service training on universal design for administrators and technical staff. Adopting such a holistic approach will enhance the inclusivity of special education institutions and contribute to the creation of equitable, safe, and accessible learning environments for all individuals.

Overall, the physical environments of special education institutions in Samsun provide positive examples of universal design, particularly in classroom organization and indoor accessibility arrangements. However, significant shortcomings remain in supporting areas such as restrooms, physical access infrastructure, and emergency preparedness. These findings demonstrate that accessibility should be addressed through a comprehensive universal design perspective rather than through isolated or piecemeal improvements. Involving individuals with diverse needs in the design process from the outset is essential for creating genuinely inclusive learning environments that extend beyond mere legal compliance. Universal design views individual differences not as barriers, but as intrinsic elements of the design process. Embedding this perspective as a core institutional culture within special education settings will enhance not only physical accessibility but also promote social equity and inclusivity.

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Implementing STEM projects in middle and high school: a model for interdisciplinary learning through practice

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Abstract

The rapidly unfolding transformations of the modern world demand new competencies that extend far beyond the memorization of theoretical knowledge. Today's students must be able to navigate complexity, critically evaluate information, engage in problem-solving, and apply interdisciplinary knowledge to real situations that mirror the challenges of contemporary society. Traditional teaching models, which fragment knowledge into isolated subjects, are increasingly insufficient for meeting these demands. Instead, education must evolve into an interconnected, interdisciplinary system in which learners develop holistic understanding by recognizing how different scientific and technological domains intersect (Anand, A., Singh, P., 2025, 233-260). Interdisciplinary teaching offers a framework for this transformation by integrating concepts, skills, and methodologies from multiple subjects in purposeful ways that enable students to construct broader, more meaningful knowledge networks (SWARGIARY, K., 2025). By combining science, technology, engineering, and mathematics into cohesive learning experiences, STEM encourages students to explore, design, and test solutions to authentic real-world problems while simultaneously developing critical thinking, creativity, and team-oriented competencies (Manchul, B., 2021, 36, 109-115).

This article examines the relevance and necessity of STEM education in contemporary school practice, with a particular emphasis on how STEM projects foster deeper understanding, scientific and digital literacy, inventiveness, and collaborative inquiry (McDonald, C., 2016, 4, 530-569). It addresses the growing need for learning that is interdisciplinary, applied, and responsive to real-world contexts, ultimately preparing students for future careers and societal participation. Additionally, the paper discusses specific challenges associated with implementing STEM instruction within Bulgarian schools and provides practical recommendations for enhancing the quality and consistency of STEM practices (Ordanovska, O., Romashchenko, K, et al., 2023, 40, 119-140). STEM education is a transformative approach that promotes experiential, meaningful learning and equips students with essential skills for navigating the complexities of the 21st century (Nguyen, T.et.al, 2020, (21), 8865).

Keywords: STEM projects, interdisciplinary learning, middle and high school education

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Introduction

In recent decades, global technological advancement, environmental concerns, the digitization of industry, and rapidly changing labor markets have reshaped expectations for what students must know and be able to do. STEM - Science, Technology, Engineering, and Mathematics - education has thus emerged as an essential cornerstone of modern educational systems. Far from being confined to scientific and technical careers, STEM knowledge supports everyday decision-making, citizenship, sustainability, and innovation across numerous fields. As a result, educators and policymakers increasingly emphasize STEM not only as a set of disciplines but also as a way of thinking and approaching problems (Dare, E. A, et. al., 2021, 11(11), 737). However, the effectiveness of STEM learning depends crucially on how it is implemented. Traditional teaching models often isolate subjects, presenting information in ways that encourage memorization rather than conceptual understanding. Such fragmentation limits students' ability to see connections between scientific ideas or apply them in authentic ways. Middle and high school students frequently struggle to understand the relevance of lessons when they are disconnected from their lived experiences. This disconnect contributes to disengagement, reduced motivation, and difficulties in transferring knowledge beyond the classroom. Implementing interdisciplinary STEM projects offers a powerful countermeasure to these issues. When students engage in hands-on investigations, design prototypes, analyze data, and explore meaningful questions, they begin to perceive learning as an active, purposeful, and connected process. Numerous studies show that project-based STEM learning strengthens not only conceptual comprehension but also essential competencies such as critical thinking, collaboration, computational thinking, digital literacy, and creativity (McLure, F.,et. al., 2022, 9(1), 73). Moreover, STEM projects provide students with opportunities to develop personal agency, resilience, and confidence - characteristics vital for both academic and professional success. The goal of this article is to present a structured model for integrating STEM projects into middle and high school education. The model emphasizes interdisciplinary integration, experiential learning, inquiry, collaborative problem-solving, and real-world application. Through this model, the article seeks to highlight how STEM projects can transform learning environments, foster deeper understanding, and prepare students for the increasingly complex demands of contemporary society.

Purpose of the Model

The primary purpose of the model presented in this article is to provide a detailed, pedagogically grounded framework for designing and implementing interdisciplinary STEM projects in middle and high school settings. The model aims to move educators beyond fragmented instruction and toward learning experiences that reflect the interconnectedness of scientific and technological fields. It encompasses several core goals.

First, the model is designed to integrate knowledge from multiple disciplines, encouraging students to view phenomena through scientific, mathematical, technological, and engineering lenses simultaneously. This integration helps learners understand that real-world problems - such as climate change, energy efficiency, environmental pollution, or technological innovation - cannot be addressed through single-subject knowledge alone. By bridging subjects such as biology, chemistry, physics, mathematics, engineering, and computer science, the model enables students to adopt multidisciplinary perspectives and construct more cohesive conceptual frameworks (Ortiz-Revilla, et.al., 2022, 31(2), 383-404).

Second, the model explicitly focuses on the cultivation of 21st-century competencies, including collaboration, communication, originality, adaptability, and critical thinking. These competencies are increasingly recognized as central to personal development, social participation, and workforce readiness. STEM projects offer an ideal context for developing such competencies because they require students to plan, communicate, negotiate roles, analyze evidence, and make informed decisions in uncertain and dynamic situations (Novia, F., et.al., 2024, 3(2), 113-124).

Third, the model aims to provide teachers with clear methodological guidance for planning, facilitating, and assessing interdisciplinary STEM learning. Many educators express uncertainty about how to implement integrated STEM instruction within existing school structures. This model supports teachers

through well-defined phases, practical examples, strategies for managing complex activities, and suggestions for combining curricular objectives with hands-on learning.

Finally, the model seeks to connect school learning with the real world, ensuring that students perceive the relevance and applicability of their education. Through real-world projects, students become active participants in inquiry, capable of constructing new knowledge rather than passively receiving information. This authentic engagement supports long-term retention, higher-order thinking, and greater motivation to pursue STEM-related careers and studies. Ultimately, the model aims to bridge the gap between theoretical knowledge and practical application, preparing students to navigate emerging global challenges and opportunities.

Method

The proposed model for implementing STEM projects in middle and high school is based on a comprehensive pedagogical framework that merges several research-supported instructional approaches: interdisciplinary curriculum design, inquiry-based learning, project-based learning, the engineering design cycle, and reflective assessment. The goal of the model is to create coherent, authentic learning experiences in which students investigate real-world problems, apply knowledge from multiple STEM disciplines, develop prototypes or solutions, and reflect on their learning process. This section presents the methodological structure in detail, highlighting both teacher-led planning and student-driven inquiry. Each phase is designed to support students' cognitive, social, and practical development, ensuring that STEM learning is not reduced to isolated activities but integrated into a broader educational ecosystem.

1. Identifying a Real-World Problem or Challenge

The first stage of the model focuses on the deliberate selection and framing of a meaningful real-world problem. Unlike traditional lessons that begin with content delivery, STEM projects begin with a context - an observable phenomenon or societal need that stimulates inquiry. The problem must be complex enough to require interdisciplinary knowledge but also accessible to students at their developmental level.

Teachers guide students through activities such as:

- brainstorming local environmental or technological challenges;
- analyzing case studies from media, scientific reports, or community issues;
- observing the school environment to detect problems (e.g., pollution, inefficiency, ecosystem changes);
- discussing their personal interests and lived experiences.

The aim is to help students recognize that scientific and mathematical concepts are not abstract, but tools for solving authentic challenges.

Example A - Biology: Ecosystems and Biodiversity (Fig. 1)

Students observe that pollinator populations appear to be declining in the urban area around their school. They examine factors such as limited habitats, insufficient plant diversity, and human activity. The resulting task - *"How can we design effective microhabitats for pollinators in the schoolyard?"* - invites exploration of ecology, engineering, mathematics, and environmental science.



Fig. 1 Ecosystems and Biodiversity

Example B - Chemistry: Water Pollution

Students sample water from local springs or rivers, noticing variations in smell, clarity, or vegetation. This leads to the problem: "What affects the pH and chemical composition of water, and how can we create a low-cost monitoring method?"

The problem connects chemical analysis, physical measurement, and technological design.



Fig. 2. Water Pollution

Example C - Physics: Energy Efficiency

Students feel or measure temperature differences in classrooms, hallways, and windows. This generates the task: *"How can we measure heat loss and propose solutions to improve energy efficiency?"*

The identification stage ensures that the project is authentic, grounded in students' surroundings, and directly linked to the interdisciplinary nature of STEM.

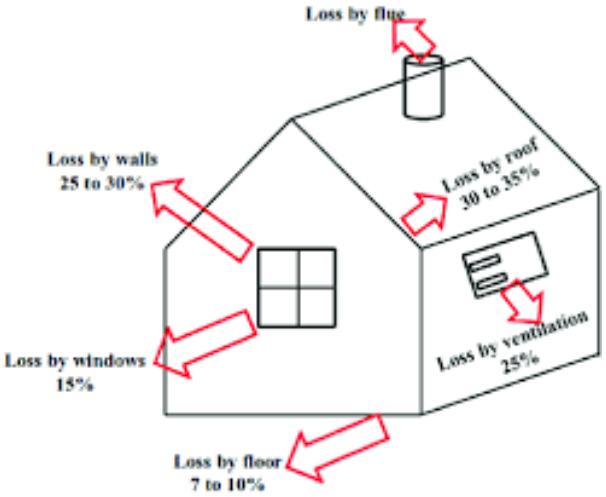


Fig. 3 Physics (Energy Efficiency and Heat Transfer)

2. Integrating Disciplines

Once the problem is defined, teachers work together to plan interdisciplinary connections across science, technology, engineering, and mathematics. This collaborative planning is crucial: interdisciplinary learning does not happen spontaneously but requires structured coordination. Teachers identify which concepts, skills, and tools from their respective subjects can meaningfully contribute to exploring the problem.

This stage typically involves:

- mapping curriculum standards and competencies across subjects;
- sequencing concepts so students acquire them when needed;
- identifying laboratory and digital tools required for investigation;
- distributing responsibilities between subject teachers;
- developing a unified project timeline.

Example - Biology + Mathematics + Technology (Pollinator Project)

- Biology: plant-pollinator interactions, species identification, ecological cycles
- *Mathematics:* frequency distribution, population sampling, statistical analysis
- *Technology:* digital mapping of pollinator locations, creation of an observation app
- *Engineering:* design, testing, and refinement of microhabitat structures (“bee hotels”)
- *Example - Chemistry + Physics + Technology (Water Quality Project)*
- *Chemistry:* detection of nitrates, heavy metals, pH, hardness
- *Physics:* light transmission, conductivity, temperature
- *Technology*: microcontrollers and sensors for automated data collection
- *Engineering:* developing a filtration or warning syste

This step transforms STEM learning from parallel disciplinary content into a unified, coherent experience where each subject contributes to solving a shared problem.

3. Project Planning and Design

The planning and design phase shifts the responsibility from teachers to students, who begin shaping the investigative process. Students engage in structured project management tasks such as setting goals, defining roles, identifying materials, and designing experimental or engineering procedures. Teachers scaffold this process by modeling how scientists and engineers plan investigations and encouraging students to consider feasibility, safety, and ethical implications.

Activities at this stage include:

- defining scientific questions, hypotheses, or engineering design criteria;
- creating diagrams, sketches, and preliminary models;
- preparing fieldwork protocols, data collection instruments, and observation tables;
- developing a project timeline with milestones;
- distributing roles such as researcher, designer, data analyst, and presenter.

Through such planning, students learn how to organize collaborative work, negotiate responsibilities, and anticipate challenges.

Example - Biology (Invasive Plant Species)

Students identify a particular area (schoolyard, park, riverbank) for fieldwork. They plan how to sample vegetation, how many observations to conduct, what data to record, and how to document specimens (e.g., herbarium sheets, photographs). Students formulate hypotheses related to species distribution (e.g., "invasive species are more prevalent near disturbed soil").

This stage builds skills such as organizational thinking, logical sequencing, and teamwork.

4. Hands-On Implementation

Implementation is the central phase of the STEM project where students apply their plans through experimentation, prototype construction, observation, and data collection. This stage reflects the authentic nature of scientific inquiry and engineering practice: students test ideas, handle equipment, troubleshoot problems, and improve their methods.

Teachers serve as facilitators, offering guidance without dictating solutions. They encourage students to:

- revise their experimental design when results differ from expectations;
- apply safety procedures and use equipment responsibly;
- record observations systematically;
- interpret data using scientific reasoning;
- iterate prototypes based on performance.

Example A - Chemistry (Bioplastic Production)

Students create bioplastic mixtures using starch, vinegar, and glycerin. They test different ratios, measure the tensile strength of hardened samples, observe flexibility, and examine biodegradability under varied conditions (e.g., moisture, pH). This process connects chemical reactions, polymer structure, and material engineering.

Example B - Physics (Light Absorption in Plants)

Students use sensors to measure oxygen production or chlorophyll fluorescence under different light wavelengths. They test lamps or filters, analyze graphs, and compare results. This reinforces understanding of photosynthesis, light absorption, and experimental accuracy.

This stage strengthens laboratory competence, problem-solving skills, and scientific precision.

5. Presentation and Reflection

After completing investigations or prototypes, students communicate their findings to peers, teachers, or external audiences. Presentation formats may include oral presentations, posters, digital portfolios, videos, scientific reports, or live demonstrations.

The goal is not only to share results but to cultivate scientific communication, argumentation, and reasoning skills.

Reflection is equally important. Students consider:

- what they learned and how their understanding changed;
- which strategies were effective or ineffective;
- how teamwork influenced progress;
- what they would modify in future iterations.

Example - Biology (Pollinator Project)

Students present maps with species observations, photographs, and the microhabitats they designed. They discuss which environmental factors influenced biodiversity, such as native plant selection or proximity to human activity. Reflection might reveal insights such as: “Our prototype attracted more bees after adding native plants instead of decorative ones.”

6. Assessment and Feedback

Assessment is multidimensional and aligns with the philosophy of STEM education, focusing not only on the final product but also on the process. Teachers evaluate individual and group performance, scientific reasoning, creativity, technical accuracy, communication, and iterative improvement.

Forms of assessment include:

- rubrics for inquiry skills, teamwork, and innovation;
- evaluation of lab notebooks and project journals;
- peer and self-assessment;
- teacher feedback on data interpretation and presentation quality;
- analysis of prototype functionality or experimental reliability.

Example - Chemistry (Water Analysis, Fig. 4)

Teachers assess the accuracy of laboratory measurements, students’ understanding of chemical reactions, and the practicality of proposed environmental solutions. Feedback may address improved measurement precision, clearer data visualization, or more effective filtration designs.



Fig. 4. Water Analysis

Conclusion of the Methodological Framework

The described six-stage methodology ensures that STEM projects promote deep learning by immersing students in the full cycle of scientific and engineering inquiry - from problem identification to communication and evaluation. The approach fosters sustained engagement, interdisciplinary understanding, and the development of essential 21st-century competencies such as critical thinking, creativity, resilience, and collaboration.

Results

The implementation of STEM projects in middle and high schools demonstrated a range of positive outcomes across academic achievement, skills development, and student engagement. Results varied according to the students' age group and level of project complexity.

Middle School (Grades 6-8)

At the middle school level, STEM projects focused on foundational concepts and hands-on experimentation. Typical projects included simple robotics challenges, designing water filtration systems, and basic coding exercises. Observed results included:

1. **Academic Achievement:** Students showed improved understanding of core science and math concepts, such as force and motion, measurement, and data interpretation. Pre- and post-project assessments indicated an average improvement of 15-20% in test scores related to project topics.
2. **Skills Development:** Collaboration and problem-solving were particularly enhanced, as students worked in small groups to design and iterate prototypes. Creativity was encouraged through open-ended project goals, such as building a model bridge from limited materials.
3. **Engagement and Motivation:** Teachers reported higher participation rates during STEM project periods compared to traditional lessons. Students expressed excitement about experimenting with tangible solutions and applying classroom knowledge in practical contexts.

High School (Grades 9-12)

High school STEM projects emphasized interdisciplinary learning and real-world problem-solving. Examples included renewable energy projects (solar panels, wind turbines), environmental monitoring with sensors, and app or website development for community issues. Observed results included:

1. **Academic Achievement:** Students demonstrated improved comprehension of complex concepts across multiple disciplines. For instance, a project designing a solar-powered water heater integrated physics (energy transfer), math (efficiency calculations), and engineering (prototype design). Post-project evaluations showed a 20-25% increase in applied STEM knowledge.
2. **Skills Development:** Critical thinking, project management, and leadership skills were strongly developed. Students were responsible for planning, testing, and presenting solutions, which enhanced both teamwork and independent problem-solving abilities.
3. **Engagement and Motivation:** High school students reported that projects made learning more relevant and enjoyable. Participation in STEM clubs and interest in STEM-related careers increased noticeably after project completion.

Overall, the results indicate that STEM projects provide meaningful interdisciplinary learning opportunities, fostering both cognitive and social-emotional growth. While middle school projects build foundational skills and curiosity, high school projects allow students to tackle more complex problems, preparing them for higher education and future careers.

Benefits and Outcomes

Implementing STEM projects in middle and high school offers a range of academic, personal, and social benefits for students. Academically, students develop a deeper understanding of core STEM concepts by seeing their application in real-world contexts. They enhance problem-solving abilities, analytical thinking, and computational skills (McLure, F.et.al., (2022). *9*(1), 73.).

On a personal level, students build creativity, resilience, and confidence as they experiment, iterate, and learn from failures. Working collaboratively on interdisciplinary projects also strengthens communication, teamwork, and leadership skills, which are essential for success in higher education and the workforce.

Moreover, STEM projects foster motivation and engagement, as students are actively involved in hands-on learning that connects to real-life challenges. Research indicates that students who participate in such projects are more likely to pursue STEM-related studies and careers, bridging the gap between school learning and future professional pathways.

Discussion, Conclusion, and Suggestions

Implementing STEM projects in middle and high schools provides a practical and effective approach to interdisciplinary learning. By integrating multiple subjects and emphasizing hands-on practice, students gain not only academic knowledge but also critical 21st-century skills such as problem-solving, collaboration, and creativity.

For successful implementation, schools should encourage teacher collaboration across disciplines, provide resources and support for project-based learning, and create a flexible curriculum that allows for experimentation and innovation. Teachers are advised to focus on real-world problems, guide students through iterative processes, and emphasize both the learning journey and the final outcomes.

Ultimately, this model bridges the gap between theoretical knowledge and practical application, fostering motivated, skilled, and adaptable learners who are better prepared for future academic and professional challenges.

Acknowledgment

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International Students' Educational Experiences in Türkiye: Challenges and Support Services

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Abstract

The aim of this study is to examine the educational experiences of international students studying in higher education in Türkiye and the relationships between these experiences and various socio-demographic variables by identifying significant correlations. Based on data collected through a survey method, factors affecting students' academic, cultural, and social adaptation were analyzed, and the findings were evaluated using correlation analysis. The study utilized data collected from 109 students, encompassing a wide range of variables including age, gender, nationality, education level, length of stay in Türkiye, Turkish language education status, internship preferences, and available support mechanisms at universities. The findings revealed statistically significant relationships between specific variables. Specifically, a moderately positive correlation was found between the length of stay in Türkiye and the academic level of students ($p = 0.001$; $r = 0.413$). This indicates a direct relationship between the time a student spends in Türkiye and their academic progress. The preference of students planning to stay in Türkiye for their internships in Turkey rather than their home countries is significant in reflecting how their future plans are shaped within Turkey ($p = 0.001$; $r = 0.347$). Furthermore, a significant relationship was found between the continent of the student's nationality and whether or not they received Turkish language training ($p = 0.002$; $r = 0.293$). This finding demonstrates that geographical and cultural contexts have an impact on educational experiences. The negative correlation observed between gender and place of residence in Türkiye ($p = 0.002$; $r = -0.293$) suggests that male and female students tend to show different preferences regarding their living environments. Furthermore, a positive and statistically significant relationship was found between age and education level ($p = 0.001$; $r = 0.343$), indicating that students tend to pursue higher academic levels as they get older. The research findings indicate that international students' educational experiences are multifaceted and not limited solely to academic performance. The availability of support services at the universities where students are enrolled emerged as a significant factor influencing their ability to understand course content. The results highlight the need for higher education institutions to develop more inclusive policies that recognize student diversity and respect cultural differences. Strengthening language education, social integration mechanisms, and career planning support systems is expected to make the educational experience of international students in Türkiye more effective and sustainable.

Keywords: Globalization in education, Support services, Cultural differences, Cultural transmission.

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Introduction

According to the Student Selection and Placement Center (ÖSYM), higher education encompasses all levels of education and training based on secondary education, lasting at least four semesters (ÖSYM, 2025). Higher education is offered at associate, undergraduate, and postgraduate levels. The concept of international students in Türkiye first emerged in the 1980s (Yılmaz and Güçlü, 2021). The Law on Foreign Students Studying in Türkiye defines a foreign student as "those who come to Türkiye by means of scholarships provided by our government to foreign governments within the framework of various agreements with relevant institutions and organizations, or through their own means" (T.C. Resmi Gazete, 1983). In a shorter definition, an international student is any student who leaves their own country to study in another country (Akpınar and Küçükgöksel, 2022). Internationalization in higher education, student mobility, and the academic and social adaptation processes of individuals from different cultures are currently important research topics on both global and national scales (UNESCO, 2022; OECD, 2023). Many factors encourage students abroad to become international students. For example, the lifestyle of the country they will go to and the opportunities the city offers, the reputation of academics, and the self-reputation of the university are among the factors influencing students' decisions (Akpınar and Küçükgöksel, 2022). Türkiye, in line with its higher education vision and the strategies and methods it has implemented for the internationalization of higher education in recent years, shows a rapid increase in the number of international students studying in Türkiye (Safawi, 2025). Other factors contributing to the increase in the number of international students are closely related to variables such as students' motivations, their region of origin, their status, and the cultural and linguistic ties between their country of origin and the host country (UNESCO, 2022; OECD, 2023; YÖK, 2025). Another factor contributing to the increase in the international student population in Türkiye is the desire of students to migrate for a certain period due to political events in neighboring countries in order to receive a better education (Akgedik Can, 2019).

The Turkish Scholarships program, in particular, plays a significant role in the host country's strategy for attracting international students. In 2024, 122,000 applications were received from 171 countries through the Turkish Scholarships program, and the number of international students studying in Türkiye reached 338,161. This number places Türkiye among the top 10 countries in the world hosting the most foreign students (AA, 2024; Yüksekova Haber, 2024). As a result of Turkey's internationalization strategy in higher education, as well as regional and cultural ties, students come to the country with different statuses such as state scholarship recipients, self-employed students, or exchange programs within the framework of international collaborations (YÖK, 2025).

Motivations for studying abroad are not limited to academic performance alone. Reasons for international students to study abroad include academic quality, career opportunities, language learning, cultural experiences, and prestigious diplomas (UNESCO, 2022; OECD, 2023). In the specific case of Turkey, affordability, scholarship opportunities, Turkish language training, and historical and cultural ties are also important factors in choosing to study abroad (YÖK, 2023). Therefore, studying abroad offers individuals not only the opportunity to acquire knowledge but also to experience new cultures, build diverse social networks, and develop a global perspective.

Globally, countries like the United States, the United Kingdom, Germany, and Canada have long been attractive destinations for international students. Their educational models stand out due to advantages such as advanced research infrastructure, world-ranked universities, and international internship and job opportunities. For example, key reasons for choosing the US include advanced research opportunities, prestigious degrees, a wide range of scholarships, and post-graduation job prospects (UNESCO IESALC, 2023). These models provide students with opportunities for transformation not only academically but also culturally and professionally.

In the context of Turkey, the rapid increase in the number of international students enhances both cultural diversity and international competitiveness in education. While there were approximately 18,000 international students at the beginning of the 2000s, this number exceeded 300,000 by 2022 (Bulut Şahin and Eriçok, 2023). It is estimated that these students contribute nearly $3 billion to the Turkish economy (Dünya, 2024). However, student experiences are not limited to academic success; they encompass multi-dimensional processes such as accommodation, language learning, sense of belonging, and social

integration. Furthermore, numerous and diverse studies exist that identify the problems international students face in the countries they study in. While the problems students experience vary depending on the characteristics of the country, the educational institution they attend, and the support provided by the student exchange program they participate in, these problems generally fall under certain headings. Accommodation, in particular, is consistently identified as a problem faced by international students in many other studies (Coşkunserçe and Bedir Erişti, 2017). Therefore, researching the educational experiences of international students in Turkey is of great importance for developing higher education policies and creating more inclusive support mechanisms.

Method

Material

The research material consists of foreign students studying at universities located in the Thrace Region of Türkiye, namely Çanakkale Onsekiz Mart University, Kırklareli University, Tekirdağ Namık Kemal University and Trakya University, which are in the Thrace Universities Union (TUB) category (Figure 1).



Figure 1. *Materials for the study.*

Thrace encompasses the part of Türkiye located on the European continent. It comprises the landmass of Edirne, Kırklareli, Tekirdağ, and parts of the European side of Istanbul, as well as the Gallipoli Peninsula in Çanakkale. This region is a key point both geostrategically and culturally. Covering an area of 23,764 km² within Turkey's borders, it shares borders with the Black Sea, the Sea of Marmara, and the Aegean Sea. An examination of the TR21 Regional Plan reveals that the universities in the region are open to development in the field of education (URL-1).

The Thrace Universities Union (TUB) was established with the aim of improving the quality of education and training among the universities within its structure; increasing the production of knowledge and technology; disseminating scientific data more effectively; supporting national development and progress; becoming a distinguished member of the scientific world by cooperating with domestic and foreign institutions; and contributing to universal development. This study aims to assess the current situation regarding the development of joint studies and collaborations targeting students from Balkan countries, as stated in Article 2 of the cooperation protocol (URL-2).

Method

Data collection tools were used in accordance with the research material. The methods followed in data collection and the statistical techniques used in data analysis are explained. A questionnaire consisting

of 24 questions was prepared to identify the difficulties faced by international students in the region regarding their education. Based on 109 responses received from students in the Balkan region, the factors affecting students' academic, cultural, and social adaptation were analyzed. The research employed a quantitative research method, one of the scientific research methods. The Statistical Package for the Social Sciences (SPSS) software package was used to input the data obtained from the quantitative research and to reach the data results.

A correlation analysis was performed between two seemingly independent variables to determine their significance. While 33% of the students have been in Türkiye for 3-5 years, 10.1% have been in Türkiye for 1 year (Figure 2). Regarding the class distribution of students in the sample, 25.7% are 3rd-year students, while 11.9% are graduates (Figure 3).

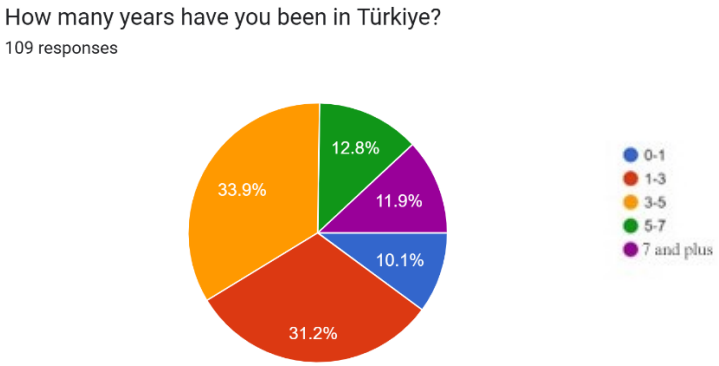


Figure 2. *Duration of stay of the sample unit in Türkiye.*

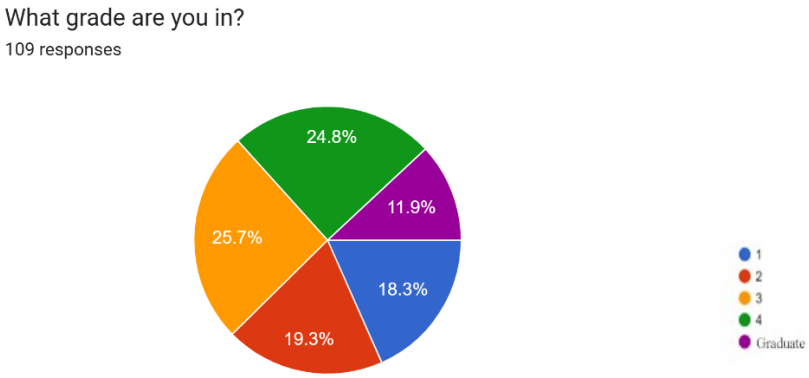


Figure 3. *The educational class distribution of the sampling unit.*

Ninety percent of the students in the sample are citizens of the European continent (Figure 4), with 63.3% being female and 33.9% male. 2.8% did not wish to specify their gender (Figure 5).

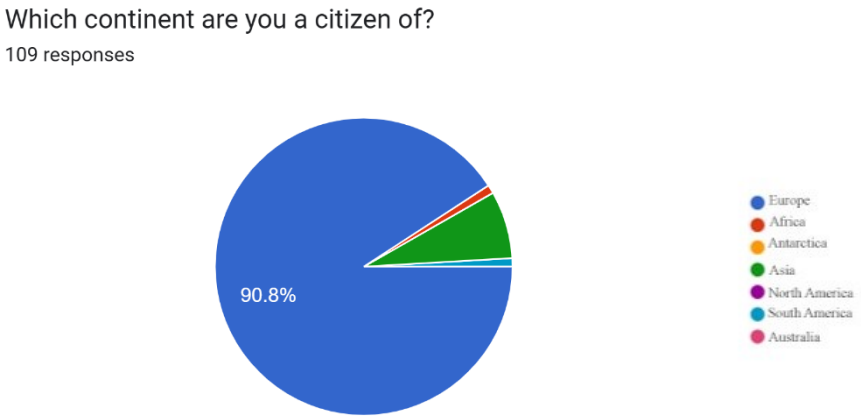


Figure 4. *Citizenship distribution of the sample unit.*

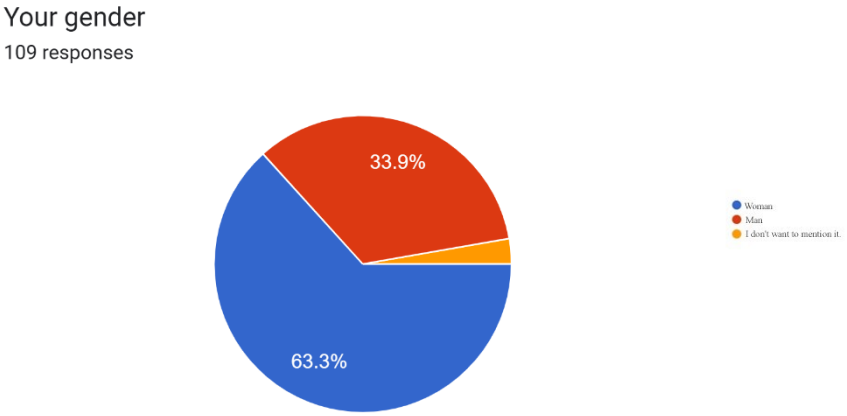


Figure 5. *Gender distribution of the sample unit.*

65% of foreign students studying in Turkey received Turkish language education in their own countries (Figure 6), 49% of these students reside in private housing, while 29.4% stay in private dormitories (Figure 7).



Figure 6. *Language education distribution of the sample unit.*

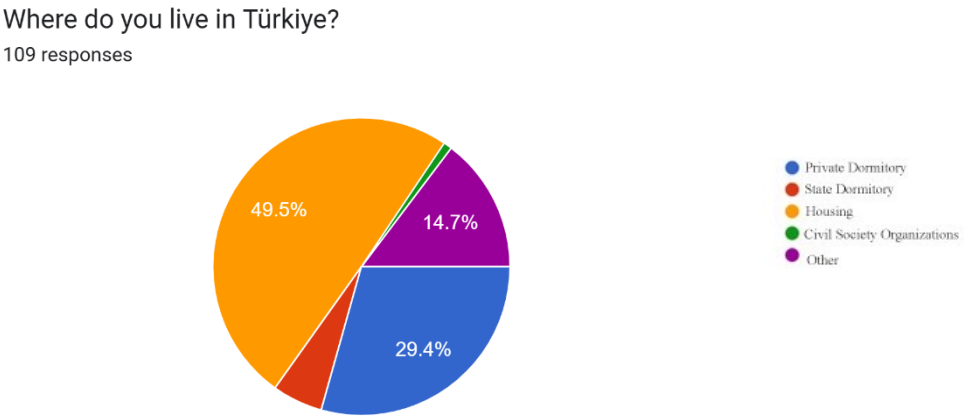


Figure 7. *The distribution of the sample unit's residences in Türkiye.*

Of the foreign students who come to Turkey for education, 56.9% prefer to do their internships in their own countries during their studies (Figure 8), while 79% of those who complete their education prefer to live in their own countries (Figure 9).

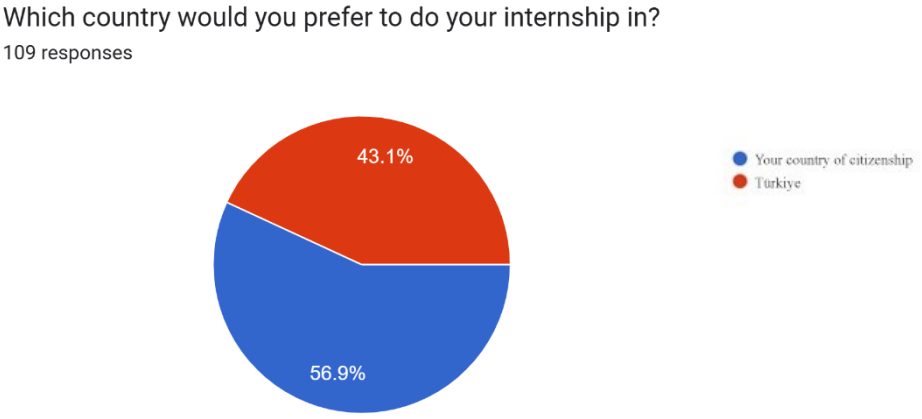


Figure 8. *The distribution of internship preferences within the sample unit.*

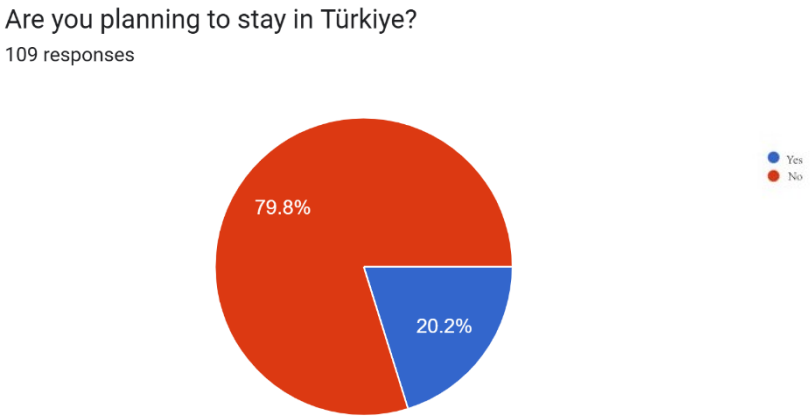


Figure 9. *Distribution of the sample unit's stay in Türkiye after education.*

Findings

The correlation analysis performed on the data obtained from the research findings revealed statistically significant relationships between certain variables. In particular, a moderately positive correlation was found between the students' length of stay in Türkiye and their education level ($p = 0.001$; $r = 0.413$) (Table 1). This indicates that the time a student spends in Türkiye is directly related to their academic progress.

Table 1.
The correlation established between the students' length of stay in Türkiye and their educational level.

			Being in Türkiye	Class
Being in Türkiye		Correlation	1	,413
		Sıgnıficance		,001
		Total Number Of Answers	109	109
Class		Correlation	,413	1
		Sıgnıficance	,001	
		Total Number Of Answers	109	109

The fact that students planning to stay in Türkiye also choose the country as their internship location is significant in terms of reflecting how their future plans are shaped within Türkiye (p = 0.001; r = 0.347) (Table 2).

Table 2.
This correlation was established between students planning to stay in Türkiye and those who chose the country as their internship location.

		Where would you like to do your internship?	Do you want to stay in Türkiye?
Where would you like to do your internship?	Correlation	1	,347
	Sıgnificance		,001
	Total Number Of Answers	109	109
Do you want to stay in Türkiye?	Correlation	,347	1
	Sıgnificance	,001	
	Total Number Of Answers	109	109

There is also a significant relationship between the continent of origin of the sample students and whether or not they received Turkish language education (p = 0.002; r = 0.293) (Table 3). This finding demonstrates that geographical and cultural contexts have an impact on educational experiences.

Table 3.
This is a correlation established between the continent the student is a citizen of and receiving Turkish language education.

		What continent are you a citizen of?	Did you receive Turkish language training in your own country?
What continent are you a citizen of?	Correlation	1	,293
	Sıgnificance		,002
	Total Number Of Answers	109	109
Did you receive Turkish language training in your own country?	Correlation	,293	1
	Sıgnificance	,002	
	Total Number Of Answers	109	109

The observed negative correlation between gender and place of residence in Türkiye (p = 0.002; r = -0.293) indicates that male and female students tend to have different preferences regarding their living environments (Table 4). This correlation also suggests that gender differences may create difficulties in the region of residence.

Table 4.
The correlation established between gender and place of residence in Türkiye.

		Your gender?	Place of Residence in Türkiye?
Your gender?	Correlation	1	-,293
	Sıgnificance		,002
	Total Number Of Answers	109	109
Place of Residence in Türkiye?	Correlation	-,293	1
	Sıgnificance	,002	
	Total Number Of Answers	109	109

A positive and statistically significant relationship was found between age and education level (p = 0.001; r = 0.343), indicating that students tend to pursue higher academic levels as they get older.

Conclusion, and Suggestions

The aim of this study, as previously stated, is to determine the educational experiences of international students studying at universities in the Thrace region and the relationships between these experiences and various socio-demographic variables. In this context, the study investigates the experiences of foreign students studying at universities in the Thrace region. Specifically, this study examines dimensions such as educational expectations, language proficiency, the impact of assessment on success, residency status, satisfaction with campus social life, social relationships, support and guidance services, and the desire to stay in the country where they wish to study.

The study revealed statistically significant relationships between specific variables. Specifically, a moderately positive correlation was found between the length of time students stayed in Türkiye (33% stayed for 3-5 years) and their academic level (25.7% were in their third year) ($p = 0.001$; $r = 0.413$). This indicates that the time a student spends in Türkiye is directly related to their academic progress. Furthermore, the fact that students planning to stay in Türkiye (79% did not plan to stay) also chose Türkiye as their internship location is significant in terms of reflecting how their future plans are shaped within Türkiye ($p = 0.001$; $r = 0.347$). Additionally, there was a significant relationship between the student's continent of origin and whether or not they received Turkish language training (65% received Turkish language training) ($p = 0.002$; $r = 0.293$). This finding demonstrates that geographical and cultural contexts have an impact on educational experiences. The negative correlation observed between gender and place of residence in Türkiye (39% residing in a home) ($p = 0.002$; $r = -0.293$) indicates that male and female students tend to have different preferences regarding their living environments. Furthermore, a positive and statistically significant relationship was found between age and education level ($p = 0.001$; $r = 0.343$), revealing that students tend to pursue higher academic levels as they get older.

33.9% of the students in the sample stated that their reason for choosing Türkiye was the availability of the department they wanted to study in. 54% stated that their educational expectation was to acquire a profession, and 42.2% stated that their life satisfaction was due to the availability of places to visit (tourism potential). 79% stated that they understood the courses in their departments easily due to language training. 41% experienced adaptation problems during their studies due to differences in education, and 30.3% due to their social environment and friendships. 38.5% received support and guidance services from their counselors, 15.6% from university officials, and 11.9% from university officials.

In conclusion, it has been determined that foreign students, predominantly from the Balkan region, have consciously chosen to study in Türkiye, have not experienced language or cultural problems, and have a high level of satisfaction.

Acknowledgment

Ethics statement: We declare that this study complies with the rules specified in the "Guidelines for Scientific Research and Publication Ethics in Higher Education Institutions" and that no actions have been taken under the scope of "Actions Contrary to Scientific Research and Publication Ethics". We also declare that there is no conflict of interest among the authors, that all authors contributed to the study, and that all responsibility for any ethical violations rests with the authors of the article.

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Model For Training and Assessment of 6th Grade Girls in Badminton

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Abstract

Badminton is a popular and very well-known sport that is practiced by many people all over the world. The simple rules of the game, the minimal conditions for it, lower costs for equipment and gear make it practically feasible in various conditions, including in the mass school.

With the increasing popularity of badminton, more opportunities for access and the most appropriate methodologies in training for practicing at school age are sought, in order to present the qualities of this beautiful and intelligent game.

By offering a training program containing sports-preparatory exercises and games, we seek to solve the task of satisfying the state requirement sand standards for the subject "Physical Education and Sports".

Keywords: physical ability, badminton curriculum, girls

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Introduction

The curricula for physical education and sports for grades 1-12 have been approved by Order No. РД09-2242/05.09.2023 of the Minister of Education and Science (published 07.09.2023). In them, in the elective area of educational content "Racket Sports", the sport "Badminton" is offered for study. Badminton in the curricula in secondary school is included in all grades.

Elementary stage (1st – 4th grade)

In the initial stage of the main activity, the goal is to introduce students to different types of sports, including badminton. Students learn the basic rules of the game, as well as basic techniques such as racket grip, strokes and movement on the court. The emphasis is on fun and the development of coordination and motor skills.

Junior high school stage (5th – 7th grade)

In the junior high school stage, students continue to improve their badminton skills. They are introduced to more complex tactics and strategies, as well as some specific strokes. During this period, emphasis is placed on physical fitness and endurance, speed, and agility.

High school stage (8th – 12th grade)

At the high school level, students who choose to continue with badminton already have a solid foundation and can focus on more specific aspects of the game. This includes improving technique, tactics, and mental toughness. Competitions and tournaments are organized where students can put what they have learned into practice and compete with their peers.

Literature Review

The state of physical ability is assessed through a system for assessing the physical ability of students from 1st to 12th grade, which is in effect from the 2019-2020 school year. The system does not include tests and standards for students with special educational needs, who are assessed in accordance with their individual growth in achievement for the relevant motor activity.

Table 1 presents the curriculum content for the sixth grade in terms of topics, competencies, expected learning outcomes, and new concepts.

Table 1
Curriculum – 6th grade

Topics	Competencies as expected learning outcomes	New concepts
Racquet sports - *badminton* • Forehand pull from right/left court • Backhand pull • Overhand pull-up • Shortening from the back line • Serve - long, short and flat serve • Chop – cutting blow	Knows and performs the basic technical elements. Understands the importance of mastering correct and effective technique in the chosen racket sport. Applies individual technical and tactical actions as a result of the actions of an opposing athlete. Describes, recognizes and applies knowledge of the rules in educational games and competitions. Applies health and hygiene requirements and ethical norms of behavior.	• counter attack • overhand pull-up • backhand download • forehand pull • shortening from the back line

Adapted Physical Education Activities	Performs motor actions according to the individual participation capabilities of persons with disabilities

Important factors influencing the effectiveness of physical education and sports activities in Bulgarian schools are the ability to collect up-to-date information about the state of the main signs of students' physical ability, the correct assessment of this information, and the knowledge and ability of teachers to take appropriate measures to improve the teaching and training process (Chanev & Mladenov, 2021).

According to Teodora Simeonova (2017), the inclusion of racket sports, in particular table tennis, badminton and chess, in the elective area of the curriculum will facilitate schools with poor material resources to implement physical education training, since they do not require a large space for practice. We can also consider as a good decision the experts from the Ministry of Education and Science regarding sports activity classes and the selection of one type of sport from the respective class (Simeonova, 2017).

Considering the technical elements set for sixth grade badminton studies, we assume that the targeted use of sports-preparatory exercises and games when working to improve them will positively affect the physical performance of 6th grade students.

Method

By studying literary sources, internet resources and summarizing pedagogical experience, we found that sports preparatory exercises and games are not used effectively enough to improve badminton technique.

The aim of the study was to establish the relationship between the use of sports-preparatory exercises and games in badminton and the physical performance of 60 6th grade students.

To achieve this goal, we set ourselves the following tasks:

1. To research, analyze and summarize literary sources.

2. To determine the physical ability of 6th grade girls and its development using specific motor tests.

3. To assess the impact of sports-preparatory exercises and games on physical performance within the framework of the sports-pedagogical experiment.

4. Based on the analysis of the experimental data obtained, draw conclusions and relevant recommendations for badminton practice and training.

THE SUBJECT of our research is the specificity of motor activity in badminton training and the possibilities for its improvement.

OBJECT of the study is the influence of sports-preparatory exercises and games on physical performance.

At the beginning and end of the school year, we conduct testing of 60 female students, divided into a control and experimental group, with the following tests:

Test: Running – 30 m (sec)

Test: Standing long jump (cm)

Test: Throwing a solid ball – 3 kg (cm)

Test: Running – 200 m (sec)

Test: T-test (sec)

Test: Movement in 4 corners of the court

When creating the complex of tests for measuring physical ability for the needs of school physical education, a set of tests that provides objective and reliable information about the basic physical qualities is sufficient.

Findings

Based on the tasks and the results obtained, we adopt the following approach to analysis and interpretation of the summarized data and parameters. Initially, we will perform a comparative analysis and determine the physical performance of the control and experimental groups – girls – at the beginning and end of the experiment. A mandatory and basic premise in the search for statistical correctness is the consideration of Student's t-criteria and the corresponding guarantee probabilities, expressed in percentages. At the conclusion of the comparative analysis between the groups, we will prove the effectiveness of the proposed new curriculum. In variational Table 2 and Table 3, data for the control group and experimental group – girls – at the beginning of the experiment are summarized. In tables 1, 2, 3, 4, 5, 6, the numbers of the tests conducted are given.

Table 2

Statistical parameters of the control group – girls – beginning of the experiment

		STATISTICAL PARAMETERS					
No.	**n**	**X min**	**X max**	**R**	**`X**	**S**	**V**
1	30	7.80	4.77	-3.03	6.79	1.49	21.88
2	30	100	177	77	152.34	34.52	22.66
3	30	250	650	400	484.11	111.01	22.93
4	30	66.20	42.60	-23.60	54.69	12.98	23.74
5	30	24	14.1	-9.9	19.02	4.57	24.03
6	30	40.21	28.77	-11.44	35.26	8.86	25.13

Table 3

Statistical parameters of the experimental group – girls – beginning of the experiment

		STATISTICAL PARAMETERS					
No.	n	**X min**	**X max**	**R**	**`X**	**S**	**V**
1	30	7.54	4.97	-2.57	6.65	1.46	21.88
2	30	120	175	55	150.12	34.02	22.66
3	30	280	620	340	489.24	112.18	22.93
4	30	67.42	45.00	-22.42	55.62	13.20	23.74
5	30	26	14.65	-11.35	19.32	4.64	24.03
6	30	41.08	31.57	-9.51	35.41	7.14	20.17

Analyzing the initial data obtained for girls, we will note that for all indicators the coefficient of variation is large for both observed groups. The values of V% from 20 to 25 percent indicate highly heterogeneous capabilities of the female students in terms of physical ability.

We performed the motor quality endurance test using the "200 m. Run (shuttle run)" test. The values of X = 55.62 sec. for EG and X = 54.69 sec. for KG show the equal capabilities of the 6th grade girls before the experiment.

Table 4

Significance of differences between mean levels before the experiment – girls

Test	KG		EG		t	Pt
	X	S	X	S		
1..	6.79	1.49	6.65	1.46	1.65	67%
2.	152.34	34.52	150.12	34.02	-1.72	69%
3.	484.11	111.01	489.24	112.18	-1.61	65%
4.	54.69	12.98	55.62	13.20	-1.30	49%
5.	19.02	4.57	19.32	4.64	-1.41	52%
6..	35.26	8.86	35.41	7.14	1.23	44%

The analysis of the mean values of the variables in the control and experimental groups for female students using the Student's t-test for independent samples (Table 4) allows us to confirm the null hypothesis regarding the significance of the differences at the beginning of the experiment. The values of t-test from 1.23 to 1.72 are lower than the critical t-test = 1.98. This is evidence of an equal start in terms of motor abilities and provides conditions for the correctness of the experiment.

Of particular interest in this study are the changes that occurred in the groups during the school year in terms of the studied indicators. Tables 5 and 6 present the results of the tests conducted at the end of the study for the control and experimental groups of girls, respectively.

The control group showed more limited progress in physical performance. In most tests, the changes were minimal, and the statistical reliability was below 88 percent.

We can report a decrease in the coefficient of variation for all indicators.

Table 5

Statistical parameters of the control group – girls – end of the experiment

		STATISTICAL PARAMETERS					
No.	n	**X min**	**X max**	**R**	**X**	**S**	**V**
1	3 0	7.55	4.80	-2.75	6.67	1.43	21.02
2	3 0	90	172	82	150.92	33.71	22.34
3	3 0	260	660	400	493.25	101.31	20.54
4	3 0	64.00	45.50	-18.50	52.81	11.21	21.22
5	3 0	18.38	15.40	-2.92	18.42	3.93	21.33
6	3 0	37.72	30.19	-7.53	33.35	6.68	20.03

The results of the experimental group of girls show progress in physical condition after the experimental period. The improvements in several key indicators are significant. In the area of speed, the 30-meter run stands out, where the average time drops from 6.65 sec. to 5.97 sec. with high statistical reliability (Pt = 95%). Coordination abilities have also improved, as seen from the results of the T-test, where the average time decreases from 19.32 sec. to 17.41 sec. (Pt = 97%). The change in the test - upper limb strength - Throwing a ball, the average value increases from 489.24 cm. to 518 cm (Pt = 96%), is also interesting.

Table 6

Statistical parameters of the experimental group – girls – end of the experiment

		STATISTICAL PARAMETERS

No.	n	**X min**	**X max**	**R**	**`X**	**S**	**V**
1	30	7.80	4.77	-3.03	5.97	0.93	15.54
2	30	100	177	77	157	17.68	11.26
3	30	250	650	400	518	103.76	20.03
4	30	66.20	42.60	-23.6	53.20	6.62	12.44
5	30	24	14.1	-9.9	17.41	3.26	18.73
6	3 0	36.28	28.27	-8.01	30.19	4.60	15.24

Also, the test reporting the speed of movement in a square showed significant progress, with an average value increasing from 35.41 sec. to 30.19 sec. (Pt = 96%) - an indicator of increased speed of arm and leg movements.

In the long jump, an increase in the mean value from 150.12 cm to 157 cm was observed, which is not supported by high statistical reliability (Pt = 75%). We can attribute this to the fact that in the game, mainly jumps are performed in height, not in length.

According to N. Yordanova (2008), a priority task of physical education in school is the development of general endurance. It is endurance in terms of prolonged work with moderate intensity (power), involving the functioning of a large part of the muscular apparatus. The differences obtained at the end of the experiment in the experimental group in terms of the Running - 200 m attribute are positive. The change from 55.62 sec at the beginning to 53.20 sec is confirmed with 95% reliability and therefore is the result of the sports-preparatory exercises and games.

The coefficient of variation marked a significant decrease in the analyzed indicators, which is an indication of the increased homogeneity of the experimental group in the final stage of the study. These results are convincing evidence of the effectiveness of the implemented methodology aimed at improving the physical performance of girls.

As we have already noted, however, the presence of differences between the average levels of the studied characteristics does not give grounds to draw serious conclusions without verifying the reliability of these statements. For this purpose, the most suitable is the comparative Student's t-test (for dependent samples). Table 7 shows the significance of the differences obtained on the studied indicators for the control group of boys.

Table 7

Significance of differences between the mean levels of the control group – girls

Test	START		END		t	Pt
	X	S	X	S		
1..	6.79	1.49	6.67	1.43	1.38	47%
2.	152.34	34.52	150.92	33.71	1.60	62%
3.	484.11	111.01	493.25	101.31	1.93	88%
4.	54.69	12.98	52.81	11.21	1.58	60%
5.	19.02	4.57	18.42	3.93	-1.16	32%
6..	35.26	8.86	33.35	6.68	1.85	83%

Table 8 shows the significance of the differences obtained in the studied indicators for the experimental group.

Table 8

Significance of differences between the mean levels of the experimental group – girls

Test	START		END		t	Pt
	X	S	X	S		
1..	6.65	1.46	5.97	0.93	2.88	95%
2.	150.12	34.02	157	17.68	-1.93	75%
3.	489.24	112.18	518	103.76	3.78	96%
4.	55.62	13.20	53.20	6.62	4.76	95%
5.	19.32	4.64	17.41	3.26	-5.11	97%
6..	35.41	7.14	30.19	4.60	3.77	96%

As a result of the interpretation of the data from the control and experimental groups of 6th grade students at the end of the study, we can make the following generalizations:

1. With a high degree of certainty, it can be stated that during the pedagogical experiment, a significant increase in the level of the studied signs occurred in the girls from the experimental group. The most significant changes in the girls were in the level of speed, endurance and agility. This opinion of ours is due to the pedagogical process of training with the applied methodology and badminton program.

2. During the same period, we also observed an increase in the control group. The changes that occurred in terms of physical ability were not proven to be significant.

3. At the end of the study, we observe a certain stabilization of the indicators for the experimental group. They retain their homogeneity.

4. It is undeniable that at the end of the study period the experimental group significantly outperformed the control group in terms of physical fitness. This is evidence of a successful choice of means, methods and their combination, reflected in the proposed curriculum.

Conclusion

As a result of the interpretation of the data from our study, we can make the following conclusions:

The analysis and summary of the literature resources proves that sports educators do not sufficiently appreciate sports preparatory exercises and games as a factor for increasing physical performance in learning badminton. This fact limits the application of various means and methods and reflects on the final result of the training.

The quantitative and qualitative results obtained at the beginning of the experiment allowed us to assess the sports and technical training of the students as satisfactory. Considering this, we can summarize that the current curriculum is not effective enough. The dynamics within the experimental research work are clearly expressed in the experimental group, where significant increases are highlighted as a result of optimized and targeted training, proven with sufficient guarantee probability.

The results of the experiment confirmed that there is an increase in physical performance when applying a specialized program. In the experimental group, which used the new tools, it is significantly higher compared to the control group, which worked according to the traditional methodology. The sports-preparatory exercises and games used have a significantly high impact on increasing the level of technical training, lead to greater emotionality, improve coordination abilities, lead to personal satisfaction, increased self-esteem, and concentration.

Based on the data obtained, tables were developed for assessing physical ability in badminton classes from the elective area "Racer Sports".

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15-17 OCTOBER 16th INTERNATIONAL BALKAN EDUCATION AND SCIENCE CONGRESS EDİRNE

Sports Activities and Quality of Life Among Primary School Students

Marija Lorger[1] **Elena Dvoraček**[2]

Abstract

The aim of this study was to investigate the quality of life of primary school students with regard to their involvements in sports activities.The research was conducted in February 2025 on a sample of 62 third- and fourth-grade students whose average age was 9.44 years.The KIDSCREEN-10 Quality of Life Questionnaire was used as the research instrument. The obtained results show that all students, regardless of their involvement in sports activities, positively assessed their quality of life.The highest levels of satisfaction with the quality of life were related to positive relationships with parents and enjoyment in school classes. Factors which also contributed to positive experiences of the quality of life included the questionnaire items describing opportunities to have fun with friends, positive perception of personal health and high levels of energy. In addition to the above, good physical fitness, effective use of free time, and a positive school environment with low levels of loneliness contributed to satisfactory assessments of the quality of life. However, although reported at low values, some experiences of sadness were indicated by students in this group, suggesting a need for further attention to children's emotional well-being.

Keywords: KIDSCREEN-10 questionnaire, male and female students, physical activity

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Introduction

The quality of children's lives can be defined as a highly subjective assessment of their physical health, emotional well-being, social relationships, and school functioning (Kolle et al., 2018). In children, the perception and understanding of the quality of life largely depend on their personal interpretation rather than solely on objective and measurable indicators (Stojić et al 2016). These indicators include physical health, emotional stability, academic achievement, leisure activities, peer relationships, and family support (Lorger, 2011).

Understanding the complexity of the quality of life concept itself requires a comprehensive approach which will emphasise the subjective evaluation of one's own life experiences (Lorger, et. al. 2012). Numerous authors have highlighted the benefits of physical exercise—particularly in relation to the perceived quality of life—manifested through its positive impact on health, the development of discipline and responsibility, and the strengthening of emotional balance (Findak & Neljak, 2007; Stojić, Lorger, & Prskalo, 2016). Furthermore, physical activity contributes to building self-confidence, perseverance, and social skills (Fraser-Thomas, Côté, & Deakin, 2005; McCall & Craft, 2002; Valjan Vukić, 2016). Regular physical activity among school-aged children has been strongly associated with better overall health, higher energy levels, and a lower risk of developing obesity and chronic diseases (Jerković & Vučković, 2010). Parental support during sports participation has a particularly strong influence on a child's motivation, persistence, and positive perception of physical activity, which indirectly contributes to a higher quality of life (Greblo & Lorger, 2006). Roca (2021) found that students with better aerobic capacity express greater satisfaction with their health, vitality, and social aspects of life. Similarly, Arsenović et al. (2022) emphasised that children engaged in regular physical activities demonstrate a better sense of physical health, psychological well-being, and social integration. Kolle et al. (2018) linked active participation in various organised sports activities to a higher level of life satisfaction among school-age children. Physical exercise has been found to positively influence several areas of child development (Bungić & Barić, 2009). Selestrin and Belošević (2022) reported that regular sports engagement helps children cope with stress and unpleasant thoughts, resulting in higher overall life satisfaction. Children who participate in the activities they enjoy tend to have a better self-image and achieve greater academic success (Tamma et al., 2013). Research by Andersen et al. (2017) demonstrated that children with better physical fitness also experience a higher quality of life, with cardiovascular fitness showing the strongest association with the perceived quality of life. Other factors like leg strength and general activity levels also positively influenced aspects such as relationships with parents and physical health. Similar results were obtained by Vella et. al. (2014). Greule et al. (2024) found that children who engaged in daily physical activities showed greater life satisfaction, higher self-esteem, and a more positive self-concept. Finally, their findings highlight that physical activity does not necessarily need to be competitive to have a positive impact on one's emotional and social well-being.

Research Aims and Hypotheses

The main objective of this research was to examine the perceived quality of life among primary school students regarding their level of engagement in sports activities. A secondary aim was to determine possible differences in the perception of the quality of life between students who regularly engage in sports and those who do not.

Based on the stated objectives, two hypotheses were formulated. The first stated that students who engage in sports activities will report a higher level of perceived quality of life (H1). The second proposed that there will be a statistically significant difference in the perceived quality of life between students who participate in sports and those who do not, in favour of the students who are active athletes (H2).

Research Methodology

This research included 62 third- and fourth-grade students, aged between 8 and 10 years. The structure of the sample by grade, gender, and level of sports involvement is shown in Table 1.

Table 1.
Participants according to grade, gender and level of sports involment

Grade	Gender	Number of students	Athletes	Non-athletes	Total
third grade	boys	11	10	1	31
	girls	20	18	2	
fourth grade	boys	13	9	4	31
	girls	18	13	5	

The KIDSCREEN-10 Questionnaire (The KIDSCREEN Group Europe, 2006; Lorger, 2011) was used in this research to assess students perceived quality of life. The questionnaire consists of 10 items describing children's perceptions of their quality of life during the previous week — covering aspects such as energy levels, parental and school environment, leisure time, peer relationships, and self-perceived health. Further demographic questions were added: grade, age, gender, and whether students were active athletes or not. Responses were rated on a 5-point Likert scale (1 = never / not at all, 5 = always / very much).

The research was conducted in February 2025 at a primary school in Bjelovar during regular physical education classes, following ethical standards for research involving children. Participation was voluntary and anonymous, with written parental consent obtained before the research. Descriptive statistics were calculated for all variables. The student's t-test for independent samples was used to examine possible differences in the quality of life perceptions based on sports involvement. In accordance with the structure of the KIDSCREEN-10, factor analysis was performed.

Results

Table 2.
Descriptive statistics for the total sample (N = 62)

Variables	*M*	Min	Max	*SD*
Physical fitness	3.77	2.00	5.0	0.89
Energy	4.02	2.00	5.0	0.97
Sadness	2.05	1.00	4.0	0.88
Loneliness	1.63	1.00	5.0	0.89
Time for oneself	3.77	1.00	5.0	1.25
Leisure time	3.82	1.00	5.0	1.17
Relationship with parents	4.53	2.00	5.0	0.86
Fun with friends	4.24	1.00	5.0	0.99
Academic success	3.92	1.00	5.0	0.93
Paying attention during classes	4.48	1.00	5.0	0.76
Health	4.23	2.00	5.0	0.84
Cronbach alpha (α)				0.67
Average item correlation				0.17

Legend: mean (*M*), minimum value (Min), maximum value (Max), standard deviation (*SD*)

The results presented in Table 2 show that all of the assessed quality of life elements were rated positively. The greatest impact on the overall quality of life is attributed to the relationships with parents, the school environment, energy levels, and self-assessed health. Low mean scores for variables expressing negative emotions (sadness and loneliness) indicate low levels of negative emotions among participants. Standard deviation values were relatively consistent, with slightly greater variability observed in the perception of leisure time. Although the internal reliability of the questionnaire (α = 0.67) did not reach the ideal threshold (α ≥ 0.80, Ravens-Sieberer et al., 2005), it approached the acceptable lower limit (α ≈ 0.70, Kline, 2005). Considering that the KIDSCREEN-10 items measure different life dimensions, this reliability level was labelled acceptable for the purpose of interpretation.

Table 3.
Correlation matrix

Variable	Physical fitness	Energy	Sadness	Loneliness	Time for oneself	Leisure time	Relationship with parents	Fun with friends	Academic success	Paying attention during classes
Physical fitness	1.00	0.54	0.01	-0.02	0.36	0.35	0.09	0.34	0.10	0.16
Energy	0.54	1.00	-0.16	-0.07	0.21	0.29	0.23	0.39	0.11	0.30
Feeling of Sadness	0.01	-0.16	1.00	0.25	0.18	-0.01	0.20	-0.03	-0.12	0.01
Feeling of Loneliness	-0.02	-0.07	0.25	1.00	-0.19	-0.05	0.01	-0.06	0.10	-0.14
Time for oneself	0.36	0.21	0.18	-0.19	1.00	0.58	0.33	0.26	0.21	0.07
Leisure time	0.35	0.29	-0.01	-0.05	0.58	1.00	0.26	0.35	0.26	0.06
Relationship with parents	0.09	0.23	0.20	0.01	0.33	0.26	1.00	0.25	0.20	0.15
Fun with friends	0.34	0.39	-0.03	-0.06	0.26	0.35	0.25	1.00	0.27	0.39
Academic success	0.10	0.11	-0.12	0.10	0.21	0.26	0.20	0.27	1.00	0.36
Paying attention during classes	0.16	0.30	0.01	-0.14	0.07	0.06	0.15	0.39	0.36	1.00
Fun with friends	0.34	0.39	-0.03	-0.06	0.26	0.35	0.25	1.00	0.27	0.39
Academic success	0.10	0.11	-0.12	0.10	0.21	0.26	0.20	0.27	1.00	0.36
Paying attention during classes	0.16	0.30	0.01	-0.14	0.07	0.06	0.15	0.39	0.36	1.00

The main factors contributing to students perceived quality of life are based on correlations between energy levels, the amount and quality of leisure time, and fun activities with friends. Academic success and classroom engagement also played a role, as both correlated positively with social enjoyment and interactions within the school environment.

Factor Structure of the Questionnaire

Table 4.
The main components

Value	Eigenvalue	Total percentage	Cumulative percentage
1	2.93	29.26	29.26
2	1.41	14.08	43.34
3	1.23	12.30	55.63
4	1.06	10.56	66.19

Factor analysis extracted four main components with eigenvalues greater than 1.0, jointly explaining 66.19% of the total variance in students' quality of life. The first component explained the largest portion of the explained variance.

Table 5.
Projections of values onto the isolated factors

Variables	*F1*	*F2*	*F3*	*F4*
Physical fitness	0.24	-0.04	-0.03	**0.83**
Energy	0.08	0.09	0.20	**0.82**
Feeling of Sadness	0.29	**-0.74**	-0.10	-0.13
Feeling of Loneliness	-0.25	**-0.82**	0.03	0.07

Time for oneself	**0.87**	0.06	0.02	0.17
Leisure time	**0.72**	0.07	0.09	0.32
Relationship with parents	**0.55**	-0.25	0.33	-0.01
Fun with friends	0.23	0.03	**0.52**	0.48
Academic success	0.19	-0.01	**0.77**	-0.05
Paying attention during classes	-0.05	0.08	**0.77**	0.21
Health	-0.24	-0.27	0.35	**0.63**

Table 5 presents the results of the factor analysis after orthogonal rotation. Three of the four extracted factors could be meaningfully interpreted. Factor one (F1) Items related to having enough time for oneself, leisure activities, and relationships with parents. → *Named as the "Leisure and Family Relationship Factor."* Factor three (F3) Items describing social activities, fun with friends, academic success, and class engagement. → *Named as the "School and Friendship Satisfaction Factor."* Factor four (F4) Items reflecting good physical fitness, energy, and health. → *Named as the "Physical Fitness, Energy, and Health Factor."* Factor two (F2) which included only two variables (feeling of sadness and loneliness), was excluded from this interpretation, although its content indicates a positive perception of well-being through the absence of negative emotions such as sadness and loneliness.

Table 6.
t- test results for independent samples based on whether the students were athletes or non-athletes

Variables	M 2 non-athletes N = 12	M 1 athletes N = 50	t	df	p
Physical fitness	3.33	3.88	-1.94	60	0.06
Energy	3.50	4.14	-2.12	60	0.04
Feeling of Sadness	2.17	2.02	0.52	60	0.61
Feeling of Loneliness	1.58	1.64	-0.20	60	0.85
Time for oneself	4.08	3.70	0.96	60	0.34
Leisure time	3.92	3.80	0.31	60	0.76
Relationship with parents	4.33	4.58	-0.89	60	0.38
Fun with friends	4.42	4.20	0.68	60	0.50
Academic success	3.83	3.94	-0.35	60	0.72
Paying attention during classes	4.25	4.54	-1.19	60	0.24
Health	3.50	4.40	-3.67	60	0.00

Legend: mean *(M),* t-test values *(t)*, degrees of freedom *(df),* significance level *(p)*

Statistically significant differences were found in only two variables: *energy levels* and *health perception*, both in favour of athletes. No significant differences were found for other variables, including physical fitness. This may be due to the unequal sample sizes, as athletes outnumbered non-athletes by a factor of four. However, comparison of the mean scores suggests that athletes displayed slightly higher physical fitness, greater parental support, better academic success, and lower sadness, though they also reported less free time and slightly higher loneliness, possibly due to sports commitments.

Discussion

The aim of this study was to examine the perceived quality of life among primary school students in relation to their participation in sports activities. All students - regardless of whether they are athletes or non-athletes reported generally satisfaction with the quality of life, consistent with previous findings by Stojić, Lorger, and Prskalo (2017). The most influential factors contributing to high life satisfaction were relationships with parents, the school environment, energy levels, and perceived health. Factor analysis revealed that students most strongly associated their quality of life with leisure

time, family relationships, friendships, and academic success, which aligns with Cummins' (2000) and Felce and Perry's (1993) definitions of quality of life which emphasise objective living conditions and subjective experiences of each individual.

T-test results confirmed that children who are athletes perceive themselves as healthier and more energetic, which is consistent with previous studies (Andersen et al., 2017; Arsenović et al., 2022). Andersen et al. (2017) found that cardiorespiratory fitness strongly correlated with better quality of life, while Arsenović et al. (2022) emphasised the benefits of physical exercise for psychophysical well-being and social inclusion. *Physical Fitness, Energy, and Health Factor* et al. (2014) also highlighted the role of team sports in promoting life satisfaction and a sense of belonging, while Selestrin and Belošević (2022) noted that physical activity improves stress management and self-image.

In this research, in addition to higher results on health and energy items, athletes achieved slightly better scores on items related to parental relationships, academic success, and class participation—even though these differences were not statistically significant. These findings further support the positive impact of physical activity on social and emotional development (Stojić et. al., 2016). A small number of athletes reported somewhat higher loneliness levels, and less free time, likely due to demanding training schedules and competition commitments. Badrić et. al. (2011) found that how children spend their free time often depends on environmental and educational factors and may be limited by school and sports obligations. The observed positive correlation between physical fitness, energy levels, social interaction, and academic success is consistent with findings reported by Lorger et. al. (2018), who emphasised that motor skills development supports group participation and enhances school performance. Similarly, UNICEF (2019) report indicated that physically active children express greater satisfaction with their health, appearance, and energy levels. Moreover, Van Oers et al. (2023) demonstrated that even overweight children who are physically active report higher subjective well-being and life satisfaction.

The main limitation of this study was the small and uneven sample size, with significantly more athletes than non-athletes, which may have influenced the results. Future research should therefore include larger and more balanced samples to verify the findings. Nevertheless, the present results confirm that physical activity positively influences multiple aspects of children's quality of life—especially perceptions of health, energy, and overall life satisfaction.

Conclusion

The aim of this study was to examine the quality of life of primary school students in relation to their involvement in sports activities, and to determine differences between athletes and non-athletes. The extracted factors—Leisure and Family Relationship Factor one (F1) and School and Friendship Satisfaction Factor three (F3) —indicate that the most important determinants of positive life perception among students are family and school environment, leisure time, and social interactions and Physical Fitness, Energy, and Health Factor four (F4) – indicate Items reflecting good physical fitness, energy, and health. Statistically significant differences were found in perceptions of health and energy, favouring athletes, while other aspects showed minor quantitative differences. The main limitation of this study remains the relatively small and unbalanced sample. In conclusion, physical activity contributes to the overall well-being and life satisfaction of primary school students, supporting both physical and psychosocial development. Future studies should explore these relationships on larger samples and include additional contextual variables such as type and intensity of sports activity.

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Integrating Biomimicry into Sustainability

Zennure Karadağ[1] **Murat Çeltek**[2]

Abstract

The increasing environmental problems and the continued depletion of natural resources have made sustainability an important concept in education. In line with this need, the 2018 Science Curriculum has placed greater emphasis on sustainability education, which aims to raise individuals with environmental awareness. In this process, the biomimicry approach inspired by nature is gaining more and more attention as an innovative educational tool for developing sustainable solutions to humancaused problems. This study examines the integration of biomimicry into sustainability education through a systematic review and bibliometric analysis using VOSviewer, revealing topic trends over the past decade. Keywords from academic studies were converted to RIS format via Mendeley and transferred to VOSviewer for visualization. Since the initial Web of Science search did not yield sufficient results, additional databases such as TRDizin, Wiley, Taylor & Francis, ScienceDirect, Google Scholar and Scopus were also scanned to obtain a comprehensive data set. The studies conducted using the keywords "sustainability" and "biomimicry in education" were examined with content analysis. 39 Studies in the field of Science Education were divided into categories according to research method, purpose, target audience, teaching approach, publication year and keywords and were visualized using graphical mapping tools. Findings show that biomimicry-based education practices significantly increase students' environmental awareness, productivity and capacity to develop sustainable solutions. In addition, biomimicry is a key 21st century skill such as problem solving, decision making, creativity, analytical thinking and critical thinking. 21st century skills are supported by design and project-based learning activities. It supports the development of 21st century skills. The literature has also shown that biomimicry applications positively affect students' problem-solving skills and sustainable environment perceptions. Therefore, adding more biomimicry-focused activities to the Science curriculum is expected to make significant contributions to the overall quality and effectiveness of the education process.

Keywords: Biomimicry, Sustainability, Science Education.

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Introduction

Humanity has been inspired by nature for a long time, consciously or unconsciously, and has continued its life by emulating the wisdom of nature. Example, as the first flying person in our historyime, consciously or unconsciously, and has continued its life by emulating the wisdom of nature. For example, as the first flying person in our history(Ersanlı, 2016). The term biomimicry comes from the Greek words ‘bios’, meaning life, and ‘mimesis’, meaning to imitate. Biomimicry is an approach that adopts the philosophy of solving human problems in a sustainable and efficient manner. It is often not possible to transfer an observation from nature directly to a product development process; instead, it takes place by completely or partially imitating the characteristics of living things, such as color, texture and function, and creatively adapting biological principles to technological products(Volstad & Boks, 2012). This concept, popularized by Janine Benyus, emphasizes the importance of sustainability in its application. Throughout history, people have looked to nature for solutions to many problems they have encountered in daily life. This concept, popularized by Janine Benyus, emphasizes the importance of sustainability in its application(Ersanlı Tezel & Ersanlı, 2023). For example, Eastgate Center stands out as an example of sustainable, energy-efficient and efficient architecture, thanks to its design inspired by termite nests(Yıldırım, 2019). Bioluminescent powered light Rods Inspired by the Flashlight Fish. Robotic Movements Inspired by Spiders. Inspired by honeycombs, large telescopes emulate the efficiency of nature's design, with each hexagonal mirror working together like the cells of a beehive to capture the light of the universe. The silent architects of nature, fungi, remind us of the basic principle of life: "Nothing is lost; everything transforms. These examples reveal that nature is an important guide in terms of technological developments. Biomimicry is considered an innovative approach due to its multidisciplinary nature and has a strong relationship with the fields of nature, biology, technology and engineering(Velioğlu & Yakışan, 2022). In explaining the fundamental principles of nature, Benyus emphasizes elements such as energy conservation, maximizing the use of solar energy, recycling, and creating forms that optimally fulfill their functions(Benyus, 1997). The importance of biomimicry for sustainability stems from its contribution to using natural resources more efficiently and reducing waste. This, in turn, enhances environmental sustainability. The flawless designs and processes found in nature inspire humans to develop more effective and innovative products; moreover, applying principles learned from nature significantly contributes to improving energy efficiency and conserving energy(Ersanlı Tezel & Ersanlı, 2023). Developing students' awareness of nature and environmental factors has become increasingly important in education. Strengthening sustainable development education, in line with the Sustainable Development Goals established by the United Nations in 2015, has emerged as a critical necessity. Skills such as learning to learn, multiliteracy, and sustainability have also been integrated into the updated curriculum. In this context, providing students with biomimicry education can contribute to the development of competent individuals capable of creating sustainable solutions and help them acquire important skills such as working collaboratively, applying scientific knowledge, and developing environmental awareness(Staples, 2005).

Biomimicry

The concept of "Biomimicry", which is the Turkish equivalent of the concept, was put forward by Benyus in 1998 and can be expanded in three different ways according to nature;

Nature as a Model; biomimicry helps humanity in solving problems that arise during the production phase by using data obtained from modeling in nature and by taking inspiration from nature in designs.

Nature as a Measure; Biomimicry is the evaluation of the accuracy of developed products by accepting ecological standards as a measure. Biomimicry is a discipline that aims to develop ecological designs by understanding the strategies that nature has developed over billions of years.

Nature as a Guide; Biomimicry is a way of knowing nature through research and understanding the value of nature through descriptions. It is a concept that tells us what we should learn from nature, not what we should take from nature(İleritürk, 2016).

Biomimicry 3.8 Life’s Principles:

Nature has found solutions to every problem it has faced for 3.8 billion years. The Lens of Life is a set of fundamental principles that guide our understanding of nature's sustainability secrets.

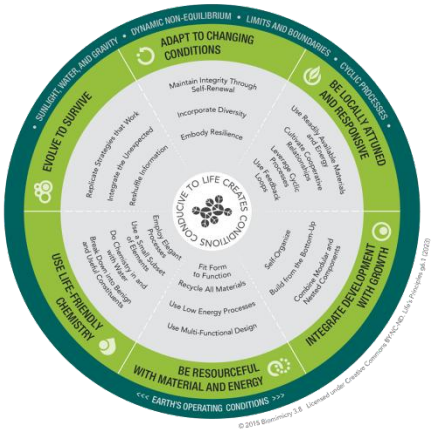


Figure 1. *Biomimicry 3.8: The Lens of Life's Principles, last accessed June 2025Biomimicry 3.8 - Innovation Inspired by Nature*

The Benefits of This Approach to Students; Provides valuable insights into how natural ecosystems maintain balance and sustain nutrient cycles. Helps students understand the principles of biomimicry and sustainable design.Encourages students to apply biomimicry to real-world sustainability challenges.Fosters creative and innovative thinking in problem-solving.

Benyus mentions nine models that he developed as principles. They essentially have the ability to reflect the nature of the ecosystem, and the use of these principles in design is necessary for ecological sustainability(Terzi, 2023). These principles can be listed as follows;

- Sunlight is important for the continuity of nature.
- Nature only expends as much energy as it needs.
- Form and functionality are in harmony in nature.
- Nature recycles everything.
- It depends on the diversity of nature.
- Nature encourages cooperation.
- Nature requires local mastery.
- Nature prevents excess from being covered up.
- Nature uses the limits of her power to the last stage(McGregor, 2013).

Sustainability

Sustainability was defined in 1972 as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs." In 1988, this concept was explained as "the eternal existence of the human species." The United Nations Development Programme introduced a total of 17 Sustainable Development Goals in 2016, providing a more holistic framework for sustainability on a global scale (United Nations Development Programme, 2016).The Sustainable Development Goals provide a global framework aimed at eradicating poverty, protecting the environment, and addressing the climate crisis. Developed by the United Nations, these goals address the economic, social, and environmental dimensions of development in a holistic manner. Among these goals, the 4th goal emphasizes the importance of raising awareness about sustainable development in society by highlighting the field of education. In this context, sustainability has become one of the basic components of education and training processes. Furthermore, the Turkish Century Education Model (2024) further strengthens the importance of sustainability in education by placing sustainability at the center and clearly emphasizes the "Sustainability-Based Science Education" approach. Within this framework, science education is positioned as a fundamental area that supports students in developing environmental awareness, responsibility, and sustainable living skills(Karasu, 2024).

Biomimicry and Sustainability

This section aims to examine the positive effects of biomimicry on sustainability. The relationship between these two concepts is vital. With the 2018 curriculum update, the concept of sustainability has gained more importance in education and has become more important in the 21st century. Various learning approaches have come to the fore that are compatible with 21st century skills. One of the most important tools of sustainability is biomimicry. Biomimicry is also called the "sustainable development ethic" because it represents a structure that is compatible with nature, sustainable and recyclable(Karabetça, 2015). "How can nature be a source of inspiration for us in our sustainability efforts?" becomes important at this point. For example, a leaf falling from a tree in nature contributes to the survival of many living things. The most suitable solutions to problems that arise in nature are found among the solutions that nature itself produces. Therefore, sustainability and biomimicry work together to develop environmentally friendly solutions, protect the world's natural balance and create a more livable standard of living(Karasu, 2024). Biomimicry offers a valuable guide to understanding how natural resources can be used more efficiently and effectively. Living things create habitats within the ecosystem using limited energy resources. For example, termites build their nests using plant and animal waste in the area where they live. In this process, they produce nitrogen, phosphorus and organic matter that enrich the soil and contribute to the increase in plant and animal diversity in the region(Blok & Gremmen, 2016). Using environmentally friendly and sustainable green energy sources can also be effective in reducing the greenhouse gas impact of fossil fuels. For example, taking inspiration from plant leaves in the design of solar panels is a good example. Similar examples can be multiplied when examining nature and living things. This study aims to emphasize the importance of biomimicry in sustainability(Palma & Lakhtakia, 2013).

The Biomimicry Design Process

It is structured around defining the problem that needs to be solved and repeating the process until the solution is at its best(Biomimicry Institute, 2017).

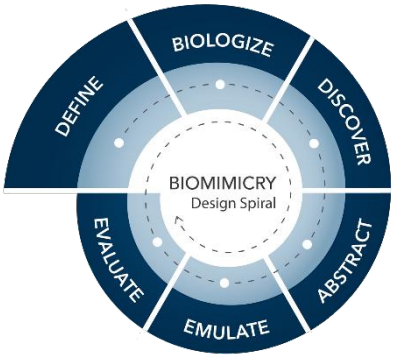


Figure 2. *Biomimicry Institute. (2017). Biomimicry Design Spiral. https://biomimicry.org/.Accessed on October 7, 2025*

Literature Review The Biomimicry Approach in Education

Educators can promote a biomimicry approach by presenting students with real-world problems and having them explore how nature has solved similar challenges(Stevens et al., 2019). By studying how natural ecosystems maintain balance and recycle nutrients, they can learn valuable lessons in building sustainable human societies(Oguntona & Aigbavboa, 2023). Educational Benefits of Biomimicry in Science Education;

- Fosters awareness and appreciation for nature's wisdom.
- Encourages creativity and supports innovative thinking.

- Stimulates curiosity and directs it toward scientific inquiry.
- Provides opportunities for research and discovery through inquiry-based learning.
- Enhances social interaction and communication through collaboration.
- Enables interdisciplinary learning and knowledge application.
- Improves scientific and environmental literacy.

Biomimicry in Science Education

In order to integrate biomimicry into education, people first need to question and try to understand how nature copes with the problems it faces(Benyus, 1997). This can only be achieved by allowing students to explore and observe nature and by helping them see nature as a guide(Collins, 2016). Biomimicry can be included in science lessons that are conducted in a planned manner(Avcı, 2019). In terms of biomimicry, integrating biomimicry applications into science curriculum topics will encourage students to imitate nature's functionality in solving problems they encounter or will encounter in their daily lives(Çoban, 2019).

Examples of National Research

In his study, Alperen(2020) implemented a STEM-based, biomimicry-focused instructional design for 5th-grade students. Conducted with a sample of 68 students, the research collected data through portfolios, rubrics, and interviews. The findings indicated that biomimicry was effectively integrated into STEM education and that students developed increased awareness of biomimicry.

In the study conducted by Velioğlu and Yakışan (2020), 7th-grade students' perceptions of biomimicry were examined through their drawings. In this qualitative research involving 30 students, participants designed technological products inspired by animals of their choice. The results indicated that biomimicry activities increased students' interest in the environment and contributed to their productivity and the development of scientific literacy.

Kandemir and colleagues (2022) examined the ability of preservice science teachers to relate examples of biomimicry to daily life and physics concepts. Conducted with 20 third-year preservice teachers, this qualitative study utilized semi-structured interviews. The findings revealed that the participants demonstrated sufficient competence in designing products inspired by biomimicry and in associating these designs with physics concepts.

In the study conducted by Sürgü and Güneş (2022), the impact of biomimicry on 8th-grade students in the technology and design course was investigated. Using an action research methodology with 19 students, the study analyzed observations, interviews, and design products. The findings indicated that biomimicry practices enhanced students' problem-solving skills, creativity, and environmental awareness, while also fostering curiosity and increased awareness toward biomimicry.

Adıgüzel and colleagues (2024) examined the effects of biomimicry-based instructional practices on teaching–learning processes. Conducted using a systematic review method, the study found that research on biomimicry has increased since 2019 and has been carried out predominantly with middle school and university students using qualitative methodologies. The review concluded that such studies are effective in fostering students' 21st-century skills and in cultivating informed and conscientious individuals.

Karasu (2024) examined the effects of biomimicry design-based science education on 8th-grade students' sustainable environmental attitudes and perceptions of problem-solving. In this quantitative study conducted with 40 students, significant improvements were observed in the experimental group, and students' project-production skills were generally found to be sufficient. The results indicate that this approach is effective in enhancing environmental attitudes and problem-solving skills.

Method

The research, which aimed to evaluate the integration of biomimicry approach into sustainability education, was conducted using the systematic review method and bibliometric analysis using VOSviewer. The review protocol of this study is divided into four stages: In the planning stage, research topics, keywords, databases and research criteria were determined. In the research stage, a detailed

search was conducted in the databases according to predetermined criteria. The research was initially started using keywords such as 'sustainability' and 'biomimicry in education' in the Web of Science (WOS) database, but when the number of studies was insufficient, searches were additionally made in Tr October, Wiley, Taylor & Francis, Sciencedirect, Google Scholar and Scopus databases and related studies were selected. Later, postgraduate studies were identified through the National Thesis Center and ProQuest databases and included in the review process. Following the screening process, 81 studies were identified in the first stage. In the selection phase, 64 studies were selected from the studies conducted with teacher candidates and students (in educational sciences) and studies determined according to criteria such as the year of publication. In the synthesis phase, 39 studies related to science education were examined. Content analysis was used in the analysis of the studies. In this regard, the data obtained were visualized with graphs by classifying the keywords, methods, purposes, target audiences, teaching approaches-methods and years used in all studies.

Findings

Table 1.

International Article Analysis Table

Reference	Purpose	Methodology
(Zhu & Klapwijk, 2022)	To support students' spatial thinking skills through design.	It is a qualitative educational research conducted with 16 students between the ages of 10-12; data was collected through video/audio recordings, student products and observations.
(Zhu et al., 2024)	Investigating the role of spatial thinking in the process of children creating design ideas through analogy.	It is a qualitative study conducted with 16 middle school students between the ages of 11-12; data was obtained from in-class recordings and student designs.
(Sumrall et al., 2025)	Connecting engineering and science education through biomimicry.	It is a qualitative teaching practice conducted with secondary school students; data were obtained from observations, designs and presentations.
(Shaw et al., 2020)	Characterization of Student Work in the Multidisciplinary Biomimicry and Robotics Unit.	5–6. it is a qualitative case study conducted with classroom students; student documentation, drawings, robot designs and coding were examined.
(Alawad & Mahgoub, 2014)	The Effect of Biomimicry Teacher on Improving Students' Thinking Skills.	Descriptive, analytical and experimental methods were used in the research; Faculty of Education 3. 30. pre-test and post-test were applied to the grade students.
(Fried et al., 2020)	Design-based learning for a sustainable future.	A mixed method was used in the research; a final project, assignments and pre-evaluation tests were administered to 91 Evolution course students.
(Jituafua, 2024)	A biomimicry-based professional development program to improve project creativity.	A qualitative method was used in the research; observations and STEM project creativity evaluation forms were analyzed on 29 science teacher candidates.
(Kelley et al., 2023)	Influencing students' STEM knowledge through collaborative teacher partnerships.	A quasi-experimental nonequivalent comparison group design was used; pretest and posttest data were collected from 1345 science and engineering students.

(Macháčková, 2023)	The Nature of Project Management in Nature: A Comparative Study in Higher Education Institutions.	This is an empirical mixed study based on research, observation and experiments; achievement tests and observations were applied to 179 students from universities A and B.
(Mejía-Villa et al., 2023)	Sustainability education through biomimicry and creative problem solving processes.	The outputs and survey data of 336 university students who participated in the Creativity, Innovation and Product-Service Design course were used in the experimental research.
(Qureshi, 2022)	The ways in which students interact with biomimicry were examined.	Using mixed methods, the research design, reports and group project scores of 70 undergraduate students were examined.
(Pauw et al., 2014)	A Comparison of Biomimicry and Cradle to Cradle Eco Design: A study on student design projects.	With a mixed research design, the "Sustainable Design Strategies" course projects of 129 undergraduate and graduate students were evaluated through content analysis and statistical tests.
(Soja, 2014)	Biomimicry, for Students to Explore the Connections Between Biodiversity, Form and Function, and Species Conservation during the Earth's Sixth Extinction.	In the qualitative research, the participation of 18 first-year university students between the ages of 18-21 in the seminar was evaluated through their observations, written reflections and projects.
(Yeter et al., 2023)	Conceptualizing Biomimicry in the Context of Engineering Among Undergraduate and High School Students: An International Interdisciplinary Study.	In the qualitative study, data were collected from 14 high school students from Singapore and 11 engineering students from the US through surveys, observations, and presentations.

Table 1 shows four qualitative studies conducted at the secondary school level. In these studies, the biomimicry approach was integrated into the education by using different teaching methods; the process and learning outcomes of the students were evaluated through their drawings, designs and presentations. At the undergraduate level, a total of ten studies were examined, three quantitative, three qualitative and four mixed.t the undergraduate level, a total of ten studies were examined, three quantitative, three qualitative and four mixed. The impact of the biomimicry approach on student success and the skills it provides in quantitative research, as well as its t the undergraduate level, a total of ten studies were examined, three quantitative, three qualitative and four mixed. The impact of the biomimicry approach on student success and the skills it provides in quantitative research, as well as its contribution to STEM knowledge, were discussed; data were mostly collected through pre-test and post-test applications. While student products and process-oriented data stand out in qualitative studies, more comprehensive data were obtained by using a combination of final scores, group assignments, tests and observations Decoupled in mixed studies. These studies include both process-oriented and result-oriented evaluation. International studies have found limited studies conducted with teachers; however, it has been observed that different research methods were used in the studies included in this review.

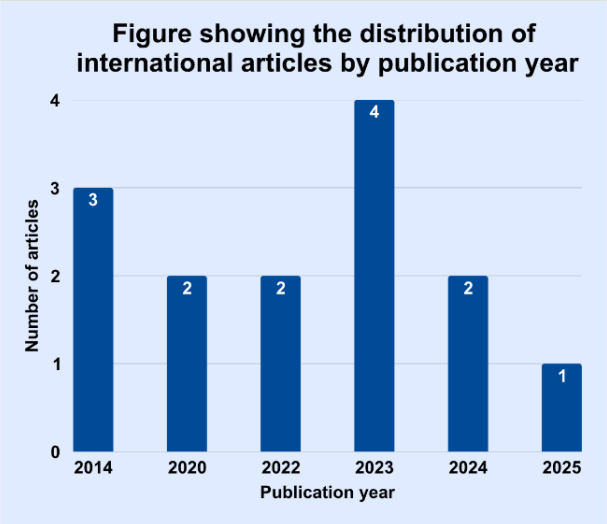


Figure 3. *Figure Showing the Distribution of International Articles by Publication Year.*

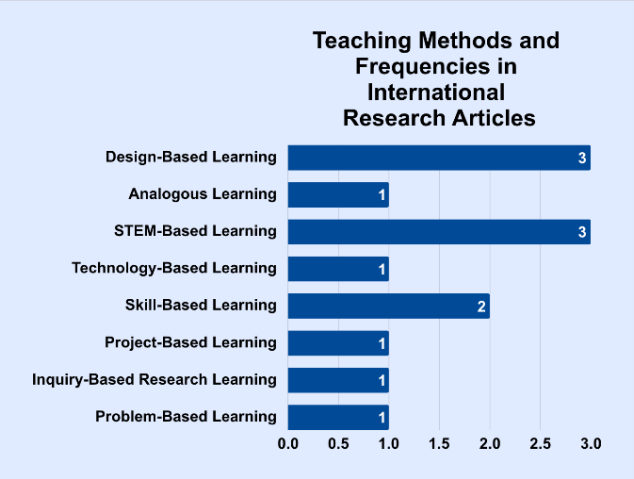


Figure 4. *Teaching Methods and Frequencies in International Research Articles*

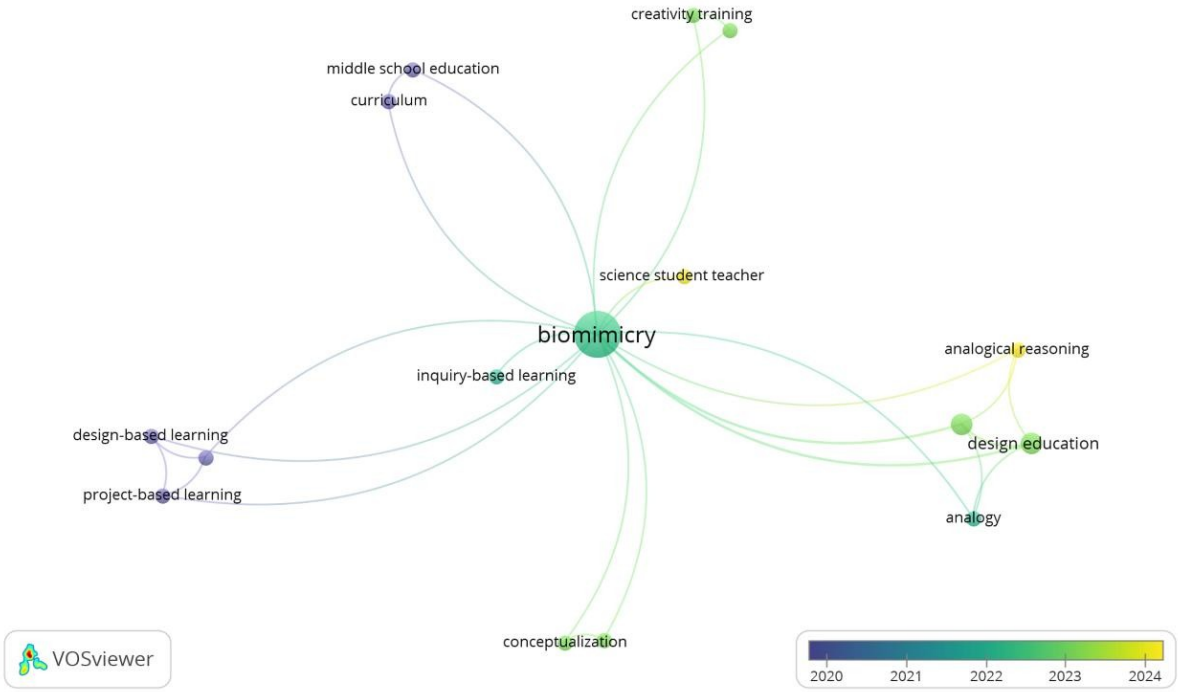


Figure 5. *Bibliometric Mapping of Keywords in International Publications (VOSviewer Analysis)*

In recent years, especially with the 2018 curriculum reform, the term biomimicry has gained significant prominence in education. It has begun to be incorporated into student learning through design-based learning and has become a concept closely associated with the STEM approach. Biomimicry, an interdisciplinary teaching approach, offers a broad framework encompassing various teaching fields. An examination of the most frequently used keywords in the diagram supports these observations and reveals recent trends in this direction.

Table 2.

National Article Analysis Table

Reference	Purpose	Methodology
(Kandemir et al., 2022)	Investigation of Science Teacher Candidates' Skills in Relating Biomimicry Examples to Physics Concepts and Daily Life	In a qualitative study using the phenomenology method, science education was conducted at a public university in the 3rd fall semester. A semi-structured interview form consisting of 15 questions was administered to 20 preservice science teachers.
(Yıldırım, 2019)	Science teacher candidates' opinions on biomimicry applications in STEM education.	In the qualitative case study, 3. teaching science at a public university in the fall semester. 17. the "Biomimicry Interview Form in STEM Education" was applied with the classroom teacher candidates.
(Çetingöz et al., 2025)	Environmental art activities experiences of preschool teachers from the perspective of sustainability education.	In a qualitative study conducted with a phenomenological design, data were collected face to face from 20 private kindergarten teachers using an interview form.

(Aydın & Kaptan, 2023)	Opinions of Secondary School Students on the Effectiveness of Science Lessons Conducted with Biomimicry.	In the qualitative study conducted in phenomenological design, semi-structured interviews were conducted with 10 students from 5th and 7th grades in a secondary school in Ankara.
(Canbazoğlu Bilici et al., 2021)	Inspired by nature: Biomimicry activity based on engineering	In the qualitative study, 8. observations, student products, reflective explanations and activity evaluations were made on 24 design. Students (12 girls, 12 boys) from the class.
(Coban & Coştu, 2023)	Integration of biomimicry into science education: Biomimicry teaching approach.	In qualitative action research, the drawings and explanations of students in individual and group work of a middle school 5th grade (10 boys, 9 girls) were analyzed.
(Mart et al., 2024)	Investigation of the Effect of Nature-to-Science Biomimicry Study on Science Motivation of Preschool Children.	In the quasi-experimental quantitative study, the Science Motivation Scale was administered as a pre-test and post-test to 24 preschool children.
(Sağir et al., 2022)	Biomimicry Awareness Among Secondary School Students.	In the qualitative case study, a semistructured interview form and a survey were administered to 50 students from different grade levels of a rural secondary school.
(Savran Gencer et al., 2020)	Developing a biomimicry STEM activity by questioning the structure-function relationship in organisms.	In the qualitative case study, activity sheets, open-ended questions, semi-structured interviews and evaluation checklists were used on 5th and 21st grade students (11 boys, 10 girls) in a public secondary school.
(Sürgü & Güneş, 2022)	The effects of teaching the biotaslit topic in the 8th grade technology and design course on students.	8 Of a village school in qualitative action research. observations, semi-structured interviews, researcher diaries and student designs were used on 19 students (12 girls, 7 boys) in the classroom.
(Tiryaki Bayram & Topbaş, 2024)	Primary School Students' Metaphorical Perceptions of Biomimicry and Engineering Concepts.	In a qualitative study with a phenomenological design, STEM activities with a biomimicry theme were implemented to 59 students in three primary schools in Ankara, Istanbul and Zonguldak, and the data were collected via Google Forms.
(Velioğlu & Yakışan, 2024)	Technological Activities Prepared by Students in Design-Based Biomimicry Activities Analysis of Models for Products.	In the qualitative case study, 7. 30 of the class students (18 of them are girls, 12 of them are boys) were examined according to the statements they wrote on the worksheets.
(Velioğlu & Yakışan, 2022)	Determining the Biomimicry Perceptions of Secondary School 7th Grade Students with Drawings.	In the qualitative case study, the 7th grade was examined by 30 students (18 girls, 12 boys) using the "I Choose Myself, I Design Myself" worksheet.
(Yakişan & Velioğlu, 2019)	Elementary school 4. analysis of drawings made by classroom students to measure their perceptions of biomimicry.	Elementary school 4 in a qualitative case study. 58 students (32 girls, 26 boys) from the class drew technological products they designed inspired by animal characteristics.

Table 2 presents three qualitative studies conducted with preservice teachers. Data in these studies were collected through interview forms, and preservice teachers' views on the biomimicry approach were examined. The comprehensive review revealed a limited number of studies involving preservice teachers. Furthermore, of the 11 national studies included in the review, 10 were qualitative, 1 was quantitative, and there were virtually no mixed-method studies. Data in these studies were primarily obtained from student drawings, worksheets, and interview forms. Quantitative studies were limited, and the lack of mixed-methods research was notable. The studies made connections to STEM and emphasized group-based activities.

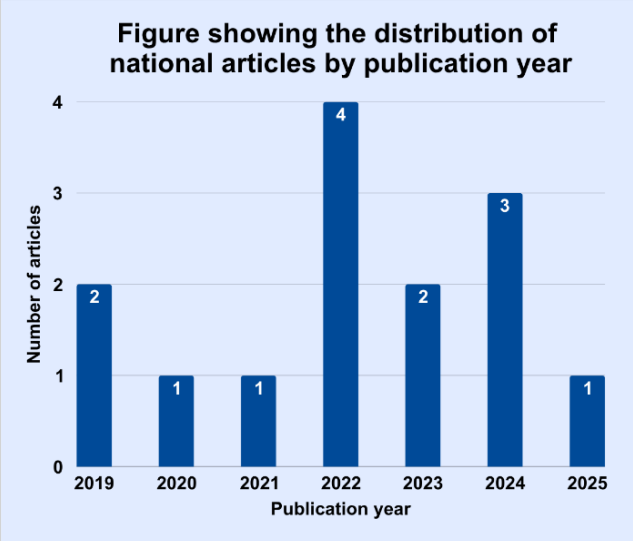


Figure 6. *Figure Showing the Distribution of National Articles by Publication Year.*

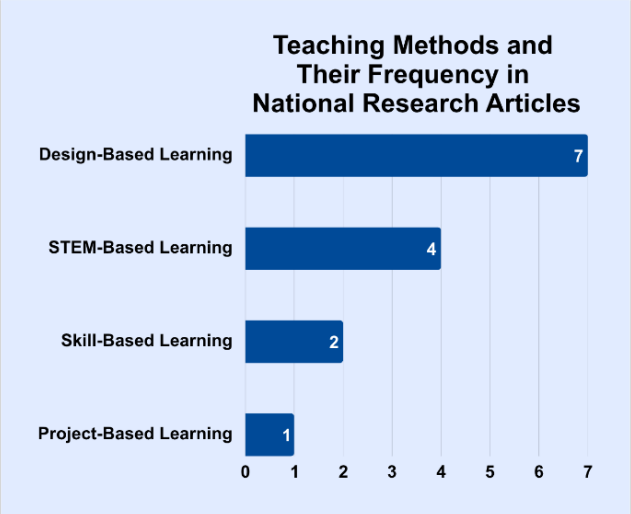


Figure 7. *Teaching Methods and Frequencies in National Research Articles*

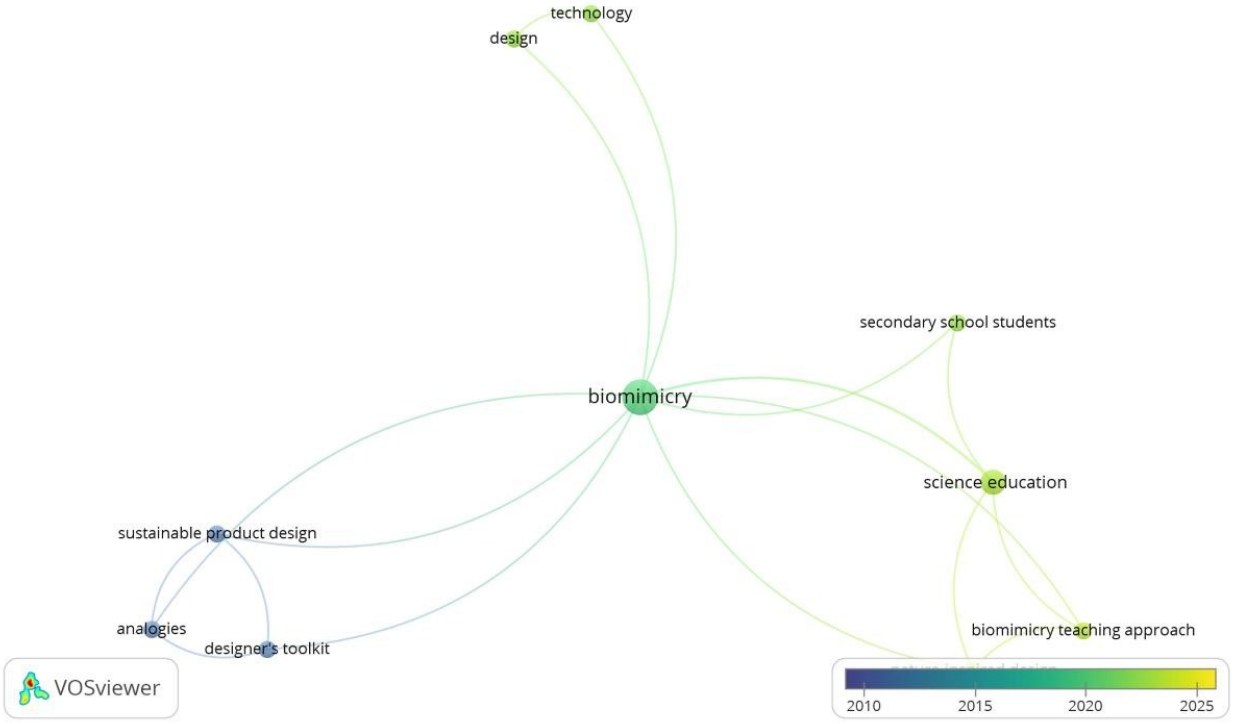


Figure 8. *Bibliometric Mapping of Keywords in National Publications (VOSviewer Analysis)*

In recent years, the biomimicry approach has emphasized the positive impact of nature-focused learning on sustainability. Science education plays a crucial role in this process, highlighting the need for research focused on student and teacher education. Research reveals that the keywords used largely focus on design-based biomimicry education.

Table 2.
National Thesis Analysis Table

Reference	Purpose	Methodology
(Alperen, 2020)	Middle School 5. a STEM-based instructional design for the classroom science applications course: Technologies inspired by nature.	In experimental quantitative study, secondary school 5. 86. portfolios, presentation rubrics and semi-structured interviews were used in the classroom students.
(Aydin, 2023)	The effect of biomimicry applications on middle school students' creative thinking skills and designs.	Pre-test-post-test in a semi-experimental model with a control group, 7. 47. the "Scientific Creativity Test (BYT)" was applied to the middle school students in the classroom.
(Çoban, 2019)	Application of biomimicry to science education.	5 In qualitative action research. data were collected from the classroom students through observation forms, semistructured interview forms and student products.
(Dündar, 2024)	Biomimicry applications supported by out-of-school learning activities.	In the mixed method, achievement test, environmental awareness and attitude scales, responsible behavior scale, semistructured

		interview form and biomimicry design evaluation rubric were applied to 5th grade students.
(Karasu, 2024)	The effect of biomimicry-based design applications on the sustainable development problem solving perception and environmental attitudes of 8th grade students was examined.	In quantitative study, 8. sustainable environmental attitude and problem solving perception scales and project evaluation rubric were applied to 40 students (19 experiments, 21 controls) in the classroom.
(Sürgü, 2022)	The effects of biomimicry applications on students in the 8th grade technology and design course.	In qualitative action research, 8. observations, interviews and document/audio-visual materials were used on 36 students (22 girls, 14 boys) aged 12-14 in the classroom.
(Ayhan Gündüz, 2024)	Development of a renewable energy themed activities module created with a STEM approach for science teacher candidates.	In the qualitative action research, 3rd grade teacher candidates (25 pilot, 25 real, total 50) were examined through their digital and in-class work and researcher observations.
(Çakır, 2019)	The awareness of biology teacher candidates about biomimicry was examined.	Department of Biology Education in Quantitative research 1-4. the "Biomimicry Awareness Questionnaire" was applied to a total of 78 students in the class.
(Gökgöz, 2022)	Analysis of pre-service teachers' biomimicry designs related to the circulatory system subject.	In the qualitative case study, 34 teacher candidates from different classes in Biology Education (23 girls, 11 boys) were examined with drawings and descriptions of the technological products they designed on 8 worksheets.
(Koşar, 2024)	The effect of biomimicry on primary education teacher candidates' science lesson plans and their views on biomimicry applications.	In the mixed study, the experimental group consisted of 42 3rd grade teacher candidates, two control groups consisted of 84 people, and the data were collected with the "Biomimicry Applications Opinion Form".
(Tavşan, 2022)	Science teacher candidates' awareness of the concept of biomimicry.	In the quantitative study, a personal information form and the Biomimicry Differential Scale were used on 151 science teacher candidates studying at two public university Education Faculties.

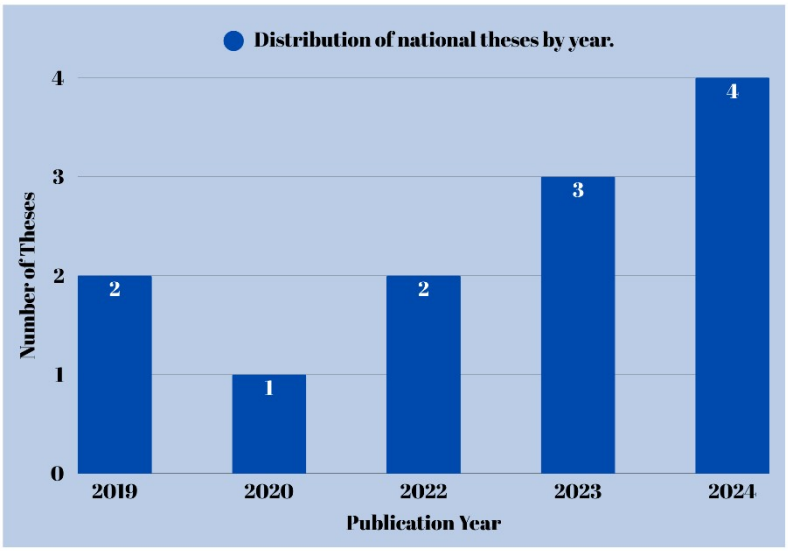


Figure 9. *Distribution of National Theses by Year.*

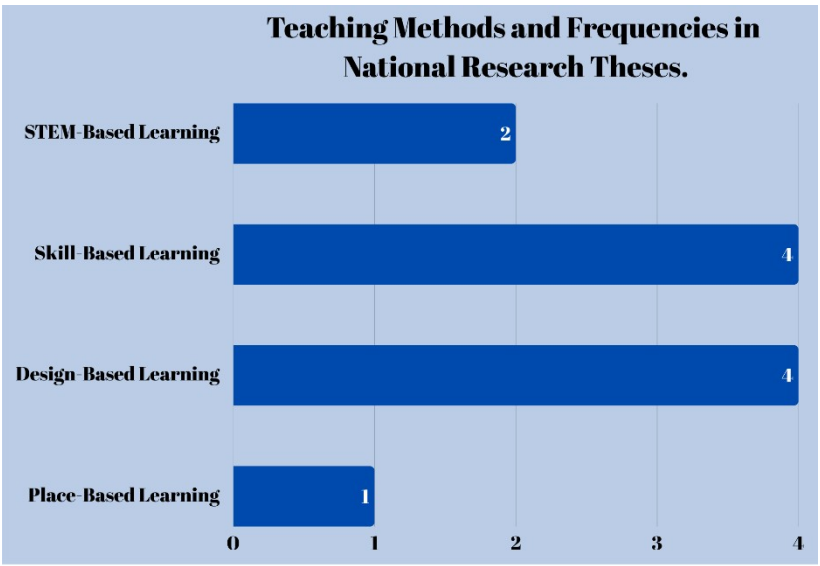


Figure 10. *Teaching Methods and Frequencies of National Theses.*

Discussion, Conclusion, and Suggestions

The findings of this research show that biomimicry and nature-based solutions (NbS) approach form a powerful complementary framework in sustainability-focused education processes. Biomimicry is an innovative method that aims to adapt the effective solutions developed by nature over millions of years of evolution to technology, architecture and engineering products. In contrast, NbS aims to produce sustainable solutions to important social problems such as climate, water, urbanization and disasters through the protection, improvement or redesign of ecosystems. When these two approaches are considered together, biomimicry provides the inspiration dimension of the design, while nature-based solutions create the application context of this design, offering nature-compatible, durable and longterm solutions. For example, while taking inspiration from plant roots or termite nests in green roof design is considered biomimicry, the transformation of this practice into an urban-scale climate adaptation strategy is evaluated within the scope of NbS(Oecd, 2021).Today, increasing environmental problems and the depletion of natural resources have increased the importance of sustainability in education. The fact that the concept of sustainability has an important place in the 2018 Science Curriculum in Turkey

aims to equip students with skills that will enable them to adapt to changing world conditions. In line with this goal, the importance of innovative approaches and practices that return to nature is increasing. Biomimicry shows that production can be done without harming nature, even by supporting nature; examples such as energy-saving structures inspired by termites, solar panels inspired by leaves, or antibacterial surfaces inspired by shark skin reveal that nature is a powerful model for technological design. In parallel with the increase in sustainability studies in the world and in Turkey, there have been significant developments in the field of biomimicry in recent years. The results of the research show that incorporating biomimicry practices into the education process provides students with multi-faceted gains. Schools are the basic environments where children who will produce future naturefriendly technologies are raised, and integrating biomimicry practices into these environments brings the innovative side of science into education. The science education program includes subjects that are directly related to bio-mimicry, such as biodiversity, energy transformations, human and environment, sustainable development and engineering design process. This relationship helps teachers teach students the 21st century through design and project-based activities. It helps them teach 21st century skills. It provides an opportunity to develop 21st century skills — problem solving, decision making, creativity, analytical and critical thinking. In fact, previous research has shown that the biomimicry approach supports scientific process skills and scientific creativity; education offers a wide range of uses that can be associated with technology. architecture and everyday life (Yıldız, 2012);(Eryılmaz, 2015);(Gardner, 2012);(Avcı, 2019). In this context, it is seen that including more biomimicry applications in the science curriculum will contribute positively to both students' problem-solving skills and their perception of a sustainable environment. Therefore, it is recommended that the approach be integrated into education programs in a more widespread, systematic and practice-based manner. In addition, it is seen that the biomimicry approach serves to raise individuals who dream, think critically and can turn these dreams into functional designs. Educational programs play a critical role in the development of such individuals, therefore it is important to strengthen the knowledge and skills of practicing teachers. Increasing opportunities for regular training, pedagogical support and professional development for teachers will improve the quality and effectiveness of biomimicry practices in the classroom. Furthermore, bringing biomimicry-based activities to different learning environments - field trips, laboratory work, workshops and outdoor applications - enriches students' learning experiences and increases the memorability of concepts. On the other hand, family-school-student cooperation is an important element in the adoption of solutions inspired by nature and in the sustainability of creative learning. In conclusion, it is thought that the more the biomimicry approach, which is compatible with the principle of vitality, is included in education, it will make significant contributions to the education of individuals who are integrated with nature, can produce rational solutions, and can use nature's unique functioning in science and technology (Aydin, 2023). Investing in the knowledge and skills of educators in this field will not only improve the quality of education; it will also provide a solid foundation for students to develop the skills of sustainability and innovation necessary to succeed in an ever-changing world.

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Conflict of Interest: There is no financial, personal or institutional conflict of interest regarding this study.

Generative Artificial Intelligence Statement: Within the scope of this study, ChatGPT and Google Gemini tools were used in the content development process. These tools were used only for language editing and increasing expression fluency and were not used in the analysis of research data, creation of results or making scientific comments. All content, findings and interpretations in the text are the responsibility of the author(s).

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The Effects of Critical Thinking on Prosocial Behavior: Theoretical and Applied Approaches

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Abstract

Prosocial behaviors are essential for fostering social harmony and constitute the foundation of interpersonal relationships. These behaviors such as helping, empathy, cooperation, and sharing—play a vital role in supporting students' social and emotional development within educational settings. In contemporary education, critical thinking skills are regarded not only as cognitive abilities but also as holistic competencies that enhance socio-emotional growth. This study examines the influence of critical thinking on individuals' prosocial behavior tendencies through both theoretical and practical perspectives.

The literature indicates that critical thinking strengthens empathy, justice, and a sense of responsibility, thereby enabling individuals to develop more sensitive and ethical attitudes in their social interactions. In the context of gifted students, critical thinking serves as a bridge that integrates cognitive potential with social awareness. Philosophy for Children (P4C) and other philosophy-based approaches, including democratic classroom discussions and ethical dilemma activities, foster students' abilities to express ideas freely, respect diverse viewpoints, and engage in cooperative decision-making processes.

Moreover, the findings highlight the importance of adapting educational programs to cultural and developmental contexts to ensure that critical thinking effectively promotes prosocial outcomes. Implementing reflective discussions, role-playing, and community-based projects can further enhance students' empathy, ethical reasoning, and collaborative problem-solving skills. By merging critical and prosocial competencies, education can nurture individuals who not only think analytically but also act with compassion and social responsibility.

In conclusion, critical thinking emerges as a fundamental skill not only for academic achievement but also for social and emotional development. It is recommended that educators design democratic and interactive learning environments that integrate critical thinking with prosocial behavior, enabling students to become responsible, empathetic, and socially engaged individuals.

Keywords: Critical thinking, prosocial behavior, socio-emotional development, gifted students, P4C

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Introduction

The healthy continuation of social life depends on the quality of relationships individuals establish with one another. In this context, prosocial behaviors refer to individuals' contributions to social harmony through social skills such as helping, showing empathy, sharing, and cooperating (Eisenberg et al., 2010). In contemporary education systems, focusing solely on academic achievement is no longer considered sufficient; fostering students' social and emotional development has become a fundamental goal (Jennings & Greenberg, 2009). At this point, critical thinking emerges as a holistic competence that enables individuals not only to engage in cognitive processes but also to make ethical and empathetic decisions within social relationships (Heyman, 2008).

Critical thinking is associated with individuals' abilities to question information, evaluate evidence, and draw logical conclusions. However, this skill plays a significant role not only in academic contexts but also in social and emotional domains. Individuals who think critically are capable of developing empathy and demonstrating prosocial behaviors by understanding and evaluating different perspectives, as well as by making fair and responsible decisions (Paul & Elder, 2006). Therefore, the development of critical thinking not only enhances students' academic success but also contributes to their growth as more conscious and sensitive individuals in social interactions.

The main purpose of this study is to examine the effects of critical thinking on prosocial behavior within both theoretical and practical frameworks. The study seeks to answer the following research question: How does the development of critical thinking skills influence individuals' tendencies toward prosocial behavior? In addressing this question, the effects of critical thinking programs—particularly within educational contexts—on social-emotional skills such as empathy, cooperation, responsibility, and fairness will be evaluated.

Additionally, the study will explore the role of developing critical thinking skills among gifted students in fostering prosocial behavior. In this regard, philosophy-based educational approaches—especially the Philosophy for Children (P4C) program—will be examined through the lenses of democratic discussion environments and ethical dilemmas. By presenting both theoretical and practical perspectives, the study aims to demonstrate that critical thinking is an indispensable tool for promoting social-emotional development in education.

In conclusion, this study aims to analyze the dynamic relationship between critical thinking and prosocial behavior, offering recommendations for educators and curriculum developers. It will emphasize that critical thinking should be understood not merely as a cognitive skill but as a way of life grounded in ethics, empathy, and social responsibility.

Literature Review

Definition and Importance of Prosocial Behavior

The literature review should critically examine previous research related to the study's topic, highlighting key findings, gaps, and theoretical perspectives. This section should not merely summarize existing studies but also demonstrate how the current research builds upon or diverges from previous work. Authors should engage with both seminal works and recent studies, ensuring a balanced perspective. The literature review should provide a conceptual or theoretical framework guiding the study and justify the need for the research based on existing gaps.

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Prosocial behaviors are forms of social conduct that encompass individuals' voluntary actions such as helping others, sharing, cooperating, and showing empathy (Caprara et al., 2017). These behaviors play a fundamental role in maintaining social harmony and strengthen feelings of trust, responsibility, and solidarity within interpersonal relationships (Busching & Krahé, 2020).

In the educational context, promoting prosocial behaviors is important as it contributes to students' social-emotional learning (van Ryzin & Roseth, 2019). Schools serve as key social environments where

children develop empathy, learn cooperative skills, and acquire a sense of social responsibility (Garaigordobil et al., 2022). Therefore, education systems should focus not only on academic achievement but also on character development grounded in social and moral values. Learning environments that foster prosocial behavior help build strong relationships among students and facilitate the peaceful resolution of conflicts.

Research has shown that prosocial behaviors have positive effects on both individual well-being and social cohesion. Prosocial individuals tend to exhibit higher levels of social acceptance, self-esteem, and psychological well-being (Caprara et al., 2005). Hence, prosocial behaviors should be regarded not merely as positive actions directed toward others but also as valuable social skills that contribute to individuals' internal development.

Supporting prosocial behaviors from an educational perspective is of critical importance for cultivating responsible individuals who will contribute to the social life of the future. In this context, prosocial behavior appears to interact with cognitive processes and can be particularly associated with critical thinking skills. The next section will discuss the concept of critical thinking and explore how these two constructs intersect at the theoretical level.

The Concept of Critical Thinking

Critical thinking is defined as a higher-order cognitive process that involves the ability to systematically analyze, evaluate, question, and make logical inferences from information (Bezanilla et al., 2019). This skill encompasses not only cognitive processes but also influences individuals' attitudes, values, and behaviors in social relationships (Dwyer et al., 2014). Contemporary approaches conceptualize critical thinking as a holistic competence that includes dispositions such as open-mindedness, intellectual honesty, empathy, and cognitive flexibility (Snyder & Snyder, 2008; Heijltjes et al., 2015). In this sense, critical thinking contributes to ethical decision-making, the development of empathy, and the formation of social responsibility at both the individual and societal levels.

From a philosophical standpoint, critical thinking represents an individual's effort to seek truth, question criteria of correctness, and assume epistemic responsibility. The Socratic method of inquiry aims to guide individuals away from dogmatic assumptions toward rational reasoning (Lipman, 2003). In this regard, critical thinking is not merely a process of acquiring knowledge but also a conscious awareness of the act of thinking itself.

In the educational context, critical thinking is viewed as a pedagogical tool designed to equip students with skills in problem-solving, decision-making, and developing multiple perspectives (Davies & Barnett, 2015). In modern curricula, critical thinking occupies a central place among 21st-century skills, contributing not only to academic success but also to social and emotional development. Through critical thinking, students learn not only how to access information but also how to approach situations with ethical awareness, empathy, and a sense of responsibility.

The social dimension of critical thinking enables individuals to respect differing viewpoints, communicate openly and constructively, and develop sensitivity toward social issues. In this context, critical thinking is directly related to prosocial behaviors. Individuals who ground their thoughts in rational reasoning strive to understand others' perspectives, develop empathy, and adopt socially responsible attitudes (Brookfield, 2012).

In conclusion, critical thinking—through its cognitive and affective components—is a multidimensional skill that influences not only academic outcomes but also individuals' behaviors in social life. The next section will examine the theoretical foundations of the relationship between critical thinking and prosocial behavior.

The Relationship between Critical Thinking and Prosocial Behavior

The relationship between critical thinking and prosocial behavior should be considered from a holistic developmental perspective that encompasses not only cognitive processes but also moral and social dimensions. Individuals with strong critical thinking skills shape their decisions based on evidence-based reasoning rather than irrational emotions, while simultaneously demonstrating a tendency to

uphold ethical values and social responsibility (Merma-Molina, 2022). In this respect, critical thinking can be regarded as the cognitive foundation of prosocial behavior.

Moral and Ethical Dimension: The process of moral reasoning involves the capacity to distinguish between right and wrong actions and to develop behaviors accordingly. Critical thinking supports individuals in analyzing ethical dilemmas, questioning diverse value systems, and making fair judgments (Leng, 2020). This process lays the groundwork for developing prosocial attitudes that consider not only one's own interests but also the rights and needs of others. According to Paul and Elder (2006), critical thinking contributes to individuals' moral autonomy and their ability to act in accordance with intellectual virtues.

Social Interaction and Empathy Dimension: Empathy, one of the core components of prosocial behavior, refers to an individual's ability to understand and share the feelings and perspectives of others. Critical thinking enhances one's capacity to evaluate situations from multiple viewpoints rather than from a single personal perspective (Guamanga, 2025). This multiplicity of perspectives encourages individuals to be more understanding and cooperative in social interactions. Research has shown that the development of critical thinking skills strengthens social abilities such as conflict resolution, active listening, and constructive communication (Brookfield, 2012).

In conclusion, critical thinking fosters prosocial behavior by deepening moral reasoning and reinforcing empathy- and cooperation-based attitudes in social relationships. In this context, critical thinking should be understood not merely as a cognitive ability but as a fundamental tool for cultivating responsible, fair, and empathetic individuals within social life. The following section will explore how this relationship manifests in the context of gifted individuals.

Critical Thinking in the Context of Giftedness

Cognitive Advantages of Gifted Students: Gifted students are characterized by advanced analytical thinking, rapid learning, the ability to comprehend abstract concepts, and creative problem-solving skills (Renzulli, 2005). These individuals not only acquire knowledge but also tend to evaluate and reconstruct it. Sternberg and Grigorenko (2003) emphasize that gifted individuals exhibit well-developed mechanisms of evaluation, inference, and metacognitive control in their thinking processes. This cognitive superiority provides a strong foundation for the development of critical thinking skills.

However, this potential cannot be expected to flourish spontaneously; educational environments must actively support critical inquiry. Structured discussions, problem-based learning, and philosophical inquiry methods help gifted students integrate depth of thought with social responsibility.

Socio-Emotional Challenges: Despite their high cognitive capacity, gifted students often experience various challenges in the socio-emotional domain. They may struggle to find common interests with peers, and perfectionism or heightened self-criticism can lead to internal conflicts (Neihart & Betts, 2010). Difficulties in empathizing or an excessive sensitivity to issues of justice may also result in misunderstandings within their social relationships.

Such challenges can hinder the natural development of prosocial behaviors. The need for cooperation, mutual assistance, and social acceptance may conflict with emotional vulnerability, despite cognitive strengths. Therefore, supporting gifted students should not be limited to academic enrichment but should also encompass the development of emotional and interpersonal competencies.

The Contribution of Critical Thinking to Gifted Students: Critical thinking serves as an essential tool for gifted students to integrate their cognitive potential with a sense of social responsibility. Facione (1990) emphasizes that critical thinking is not merely the ability to analyze and evaluate but also involves dispositions such as open-mindedness, empathy, and intellectual honesty. These qualities help gifted individuals develop more balanced, understanding, and fair attitudes in their social interactions.

Activities such as philosophical inquiry (Philosophy for Children, P4C), ethical dilemmas, and group discussions encourage gifted students not only to pursue "the right answer" but also to embrace the responsibility of understanding others' viewpoints (Lipman, 2003). Through critical thinking practices, they begin to interpret empathy as a cognitive process and internalize prosocial behaviors.

In conclusion, critical thinking is not only a determinant of academic success for gifted students but also a fundamental developmental tool for social adjustment and emotional maturity. In this regard, critical thinking functions as a bridge that transforms the potential of gifted individuals into meaningful social contribution.

Applied Approaches

Philosophy for Children (P4C) and the Lipman Model: Philosophy for Children (P4C), developed by Matthew Lipman, is an educational approach designed to foster students' thinking, discussion, and ethical reasoning skills (Lipman, 2003). The fundamental principle of P4C is to create a democratic and participatory classroom environment where students can express their ideas freely, learn to respect the opinions of others, and engage actively in collective decision-making processes. This approach directly contributes to the development of prosocial skills such as empathy, justice, responsibility, and cooperation (Trickey & Topping, 2004).

Example Activity: "Justice or Equality?": Students are presented with an ethical dilemma in class: Is it fair to allocate more resources to a certain group of students, or should all students receive equal resources? Working in groups, they discuss the issue, defend different viewpoints, and ultimately reach a class consensus. This activity integrates critical thinking with empathy and a sense of justice.

Other Pedagogical Approaches

Group Discussions and Socratic Inquiry: In this method, students engage in group discussions on specific topics and are encouraged to question and analyze their ideas through guided questioning. It strengthens students' critical reasoning abilities while also fostering prosocial behaviors such as cooperation and respectful communication.

Role-Playing (Drama) Activities: Through assuming the roles of others, students have opportunities to develop empathy and social awareness.

Example Activity: "Two Friends and the Lost Item." Students examine a situation from different perspectives and propose possible solutions. This process enhances social-emotional learning and problem-solving skills.

Collaborative Decision-Making and Class Councils: Learning environments where students participate in class management promote a sense of responsibility and democratic engagement. Shared decision-making processes encourage students to act with consideration for others' needs and strengthen prosocial attitudes such as cooperation.

Social Problem-Solving Activities: Students discuss social challenges they encounter in or outside the classroom and propose potential solutions. This approach integrates critical thinking with social responsibility and empathy.

Example Activity: Developing strategies in groups to resolve conflicts among classmates.

In conclusion, P4C and other pedagogical approaches integrate critical thinking skills with prosocial behaviors, supporting students' cognitive as well as social-emotional development. These methods, particularly within democratic and interactive learning environments, enable students to cultivate essential competencies such as social responsibility, empathy, and cooperation.

Discussion, Conclusion, and Suggestions

This study examined the relationship between critical thinking and prosocial behavior within both theoretical and applied frameworks. The findings indicate that critical thinking is a holistic competence encompassing not only cognitive processes but also social-emotional development. A review of the literature reveals that critical thinking skills significantly support prosocial behaviors such as empathy, fairness, cooperation, and responsibility (Merma-Molina et al., 2022; Bezanilla et al., 2019).

Educational practices such as Philosophy for Children (P4C) and other forms of democratic classroom discussion strengthen students' abilities to understand diverse perspectives and engage in ethical reasoning. This process enhances students' social awareness and reinforces prosocial attitudes such as group communication and collaboration (Daniel & Auriac, 2011; Shih, 2024). In the context of gifted

students, critical thinking serves as a bridge between cognitive capacity and social-emotional awareness, fostering empathy and a sense of justice while contributing to the development of more balanced and sensitive interpersonal relationships (Tsai, 2024).

The findings confirm that critical thinking is not confined to academic achievement; rather, it plays a crucial role in nurturing responsible, empathetic, and cooperation-oriented individuals within society. However, the effectiveness of such educational practices may vary depending on students' age, cognitive level, and cultural context. Therefore, it is essential that educational programs and activities be adapted to local contexts.

In conclusion, critical thinking and prosocial behavior are mutually reinforcing domains. Designing educational environments that are democratic, participatory, and interactive allows students to develop both cognitively and socio-emotionally. Teachers and educators can strengthen the integration of critical thinking and prosocial behavior by emphasizing practices such as P4C, democratic classroom discussions, role-playing, and collaborative decision-making activities.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Introducing Philosophy in Pre-Scholl: Philosophy for Children

Özge Özkan Kılıç[1]

Abstract

Acquiring key cognitive skills such as thinking, problem solving, creativity, and critical thinking at an early age is a crucial factor that supports children's interest in learning and mental development throughout their lives. However, early childhood is not only a period in which cognitive skills are formed, but also a period in which social skills are shaped and which influences an individual's life-long capacity for social integration. Throughout this process, children learn to collaborate with their peers, share, express their feelings and opinions, respect other people's ideas, and form empathy. This is critical for both their individual development and their social integration.

The Philosophy for Children (P4C) Approach, which has become increasingly popular in recent years in our country and aims to develop thinking and social skills in children in a holistic manner, stands out as one of the most comprehensive and effective methods in this field. The objective of the P4C approach is to reinforce children's ability of thinking, understanding, and discussion. In this method, children are encouraged to think deeply about the topics and concepts they encounter, thereby developing critical, creative, caring, and collaborative thinking skills.

The objective of this study is to review experimental research that has identified the contributions of Philosophy for Children (P4C) practices in the pre-school period to children's thinking and social skills. In this study, designed as a thematic review, national and international studies published between 2010 and 2025 were screened, and 18 studies conducted in an experimental design with pre-school children, examining the impact of philosophy practices for children on their thinking and social skills, were conducted. The findings suggest that P4C promotes children's critical thinking, creative thinking, reasoning, problem solving, theory of mind, high-level thinking, and cognitive thinking skills, while reinforcing their understanding of emotions, social competence, empathy, social relationships, communication, sharing, listening, social rules, and social problem-solving skills.

Keywords: Pre-school, philosophy for children, thinking skills, social skills

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Introduction

From ancient times to the present, thinking has been one of the fundamental subjects of philosophical and scientific studies. This abstract and complex concept has been extensively discussed, especially during the period of Greek philosophy, and has been defined in various ways by different philosophers. Among ancient Greek philosophers, Socrates (470 BC - 399 BC), of whom we have heard from the most, considered thinking not only as a means of producing knowledge, but also as a fundamental process of life, and therefore placed it at the center of philosophy. Plato (427 BC - 347 BC), who was his pupil, defines Socrates's way of thinking as "thinking upon thinking", and emphasizes that philosophical dialogue is an essential tool for deepening thought (Türkçapar, Kahraman & Sargın, 2015). The "Socrates method" developed by Socrates is known as a questioning technique that aims to reveal the unknown through questions and answers and to arrive at the truth by resolving contradictions in one's thinking. Nowadays, this approach, known as the "Socratic thinking", plays an integral role in education in order to develop critical thinking and organize thoughts systematically. Furthermore, understanding that thinking plays a fundamental role in individual's sense of self, decision-making processes, and the formation of ethical values is a critical aspect that strengthens the connection between philosophy and education (Altorf, 2019:3; Direk, 2016; Mareš *et al*., 2021)

In accordance with the framework outlined by the 21st Century Learning Partnership (P21 Early Childhood Guide), it is of great importance that 21st century skills-critical thinking, collaboration, communication, creativity, technological literacy, and social-emotional development-are established during early childhood (18 months-6 years) (P21 Early Childhood Guide, 2019). This approach is based on the idea that early childhood is a pivotal period in shaping an individual's lifelong learning habits. As a matter of fact, numerous studies have demonstrated that the cognitive, social, and emotional skills acquired during this period have lasting effects on the individual's later stages of education and adult life (Denham *et al*., 2014; Rhoades *et al*., 2011; Mercan, 2022). Accordingly, one can say that early childhood education is a strategic process that goes beyond merely meeting basic developmental needs, but also supporting the individual's future learning capacities, problem-solving competencies, and social adaptation skills.

The “Philosophy for Children (P4C)” approach developed by Matthew Lipman is a pedagogical approach that seeks to support children's intellectual and social development through philosophical inquiries. The Philosophy for Children approach, abbreviated as “P4C” in the literature, has a broader perspective, not only as an application intended for children, but also with its different interpretations. In addition to the first interpretation of this abbreviation, “Philosophy for Children,” there is also the interpretation, “Philosophy for Communities,” which emphasizes its applicability to individuals and communities of all ages. Additionally, P4C is defined as an approach that emphasizes critical, creative, collaborative, and caring thinking styles and community skills (Özdemir, 2021:4; Pritchard, 2002; Yılmaz & Bilican, 2021:15). This multi-faceted approach demonstrates that P4C is not merely an effort to develop thinking skills, but also supports children in generating creative solutions in their problem-solving processes, establishing cause and effect relationships, and anticipating possible outcomes. Additionally, P4C contributes to the development of children's social skills, such as listening attentively, waiting for their turn to speak, respecting different views, and being tolerant, thereby addressing cognitive and social development with a holistic approach (Pritchard, 2002).

Mathew Lipman (1923-2010) was the first to propose the idea of engaging in philosophy with children in the 1970s as one of the approaches that best utilizes the power of questions (Figueiredo, 2022; Juuso, 2007). Lipman brought a different perspective on thinking to the conversation, stating that university years are too late to study philosophy and that the earlier one starts cultivating thinking in children, the more successful it will be. While common prejudices against early philosophy education continued, Matthew Lipman's idea that “one should start early” marked a turning point that challenged the developmental presumptions prevalent at the time (Lipman, 1976:21). The significance of this turning point is related to the fact that Piaget's theory of cognitive development, which argues that children can only engage in abstract and philosophical reasoning once they have reached certain levels of cognitive maturity, has long been the sole determining factor.

Jean Piaget's cognitive development theory argues that children cannot perform certain mental tasks until they reach a certain age and that their thinking skills are limited by their level of maturity (Bjorklund, 2021:160, 181). Based on this perspective, it has been argued that young children are not capable of abstract and philosophical thinking, and that this ability usually emerges in mid-childhood, or even towards adolescence (around 15-16 years of age) (Fox, 2001). However, advocates of Philosophy for Children (P4C) fundamentally challenge this claim with findings and classroom observations showing that young children are capable of abstraction and can discuss concepts such as courage, justice, good, and evil by relating these to their daily experiences (Egan, 2011; Murris, 2001). As a matter of fact, Lipman considered Piaget's view that children cannot engage in abstract thinking until a certain age to be inadequate (Lipman, 1976:21). In her book Children's Minds (1978), psychologist Margaret Donaldson points out that children often successfully accomplish in their daily lives what they were unable to accomplish in Piaget's experiments (Donaldson, 1978; McCall, 2017:21).

The Philosophy for Children approach is based on the educational views of John Dewey and Lev S. Vygotsky, who emphasized thinking rather than memorization. Dewey emphasizes that participatory citizenship, which is essential for democratic life, is strengthened by the skills of questioning, problem solving, and cooperation; and that unless these skills are systematically cultivated, neither society can be considered "civilized" nor education "satisfactory" (Lipman, 2003). P4C's focus, the "community of inquiry," is a learning model in which individuals resolve conceptual uncertainties together, share and test evidence and reasoning, and learn to think by "practicing" in a climate of mutual respect and intellectual responsibility. This model combines Vygotsky's support mechanisms with Dewey's empirical-democratic approach; it removes the teacher from the role of absolute knowledge transmitter and places them in the position of facilitator of thinking and regulator of dialogue. As a result, children do not merely "learn" concepts; they also internalize the ability to draw connections between concepts, substantiate their arguments, respond sensibly to their peers' reasoning, and revise their own views when necessary (Cam, 2023:21).

Recent studies have also demonstrated that philosophical dialogues can be applied in the pre-school years and contribute to children's cognitive and social skills (Akan & Bilgin, 2022, Avcı *et al*., 2021). In this context, the present study compiles the research that examines the contributions of P4C practices to children's development in the pre-school period.

Method

This study was conducted using the thematic analysis method, which is one of the qualitative study designs. Boyatzis (1998) defines thematic analysis as a qualitative analysis method used to identify, analyze, and report patterns (themes) within data.

In this study, a search was made in the Web of Science, Scopus, ERIC, Google Scholar, and Ulakbim databases using the keywords "philosophy for children," "pre-school," "thinking skills," and "social skills". 18 experimental studies published between 2010 and 2025 and conducted in the pre-school period (ages 3-6) were included in the review. Through thematic content analysis, the articles were evaluated under two main themes, "contribution to thinking skills" and "contribution to social skills".

Results

Table 1.
Yearly Distribution of Studies Examining the Impact of P4C Practices on the Thinking Skills of Pre-school Children

Year	f	%
2012	2	15.4
2015	1	7.7
2016	1	7.7
2017	1	7.7
2018	1	7.7
2019	2	15.4
2020	1	7.7
2022	2	15.4

2023	1	7.7
2025	1	7.7
Total	**13**	**100**

Looking at Table 1, it can be noted that the frequency distributions of studies examining the effect of P4C practices on the thinking skills of pre-school children show an overall homogeneous pattern over the years. Regarding the data on the working group, the vast majority of frequencies consist of a single study at a rate of 7.7%, whereas only in 2012, 2019, and 2022 did the frequency rise to 2, each accounting for 15.4% of the total number. This finding indicates a relatively higher concentration in the years in question compared to other years. However, over the years, no significant increase or decrease trend has been observed. Consequently, it can be concluded that the distribution of data over the years follows a balanced trend, although there are limited concentrations in some years.

Table 2.
Subjectwise Distribution of Studies Examining the Impact of P4C Practices on the Thinking Skills of Pre-school Children

Subject	f	%
Critical Thinking	7	30.4
Creative Thinking	4	17.4
Reasoning	3	13.0
Problem Solving	2	8.7
Theory of Mind	2	8.7
High-Level Thinking	1	4.3
Cognitive Skills	4	17.4
Total	**23**	**100**

Table 2 shows the distribution of studies addressing focusing on thinking skills in P4C practices in the pre-school period. The findings indicate that the studies focused mostly on critical thinking skills (f:7, 30.4%). Creative thinking (f:4, 17.4%) and cognitive skills (f:4, 17.4%) came in second place. Reasoning (f:3, 13.0%), problem solving (f:2, 8.7%), theory of mind (f:2, 8.7%), and high-level thinking (f:1, 4.3%) were studied at lower rates. These results show that critical thinking skills in particular stand out as a priority research area in P4C research in pre-school settings.

Table 3.
Yearly Distribution of Studies Examining the Impact of P4C Practices on the Social Skills of Pre-school Children

Year	f	%
2013	1	20
2022	1	20
2023	1	20
2024	1	20
2025	1	20
Total	**5**	**100**

Looking at Table 3, it can be noted that the frequency distributions of studies examining the effect of P4C practices on the social skills of pre-school children show an overall homogeneous pattern over the years. The fact that there was one study each in 2013, 2022, 2023, 2024, and 2025 reveals that studies investigating the effect of P4C on the social skills of pre-school children have emerged in the literature in recent years, yet there is still insufficient research on this subject.

Table 4.

Subjectwise Distribution of Studies Examining the Impact of P4C Practices on the Social Skills of Pre-school Children

Subject	f	%
Understanding Emotions	1	9.1

Social Competence	1	9.1
Empathy	1	9.1
Collaboration	2	18.2
Social Relations	1	9.1
Communication	1	9.1
Sharing	1	9.1
Listening	1	9.1
Social Rule	1	9.1
Social Problem Solving	1	9.1
Total	**11**	**100**

Looking at the findings in the table, it can be observed that 18.2% of a total of 11 studies focused on collaboration skills (f:2). All other subjects (understanding emotions, social competence, empathy, social relations, communication, sharing, listening, social rules, and social problem solving) were represented at a rate of 9.1% (f:1). This shows that the research largely reflects a homogeneous distribution, with an emphasis on collaboration skills over others. The results demonstrate that P4C practices contribute to social skills in multiple dimensions; however, they also indicate a need for more in-depth studies on skills such as empathy, understanding emotions, and social problem-solving.

Conclusion, Discussion, and Suggestions

Research findings reveal the distribution of experimental studies conducted on children's thinking and social skills in relation to “Philosophy for Children” (P4C) practices carried out in the pre-school period by year and subject. Data obtained indicate that there are a limited number of studies in both cognitive and social dimensions, although existing studies show meaningful diversity.

When research focusing on thinking skills is reviewed, it is clear that the distribution over the years has generally followed a balanced trend, but there has been a relative increase in the years 2012, 2019, and 2022. The distribution by subject revealed that critical thinking skills received the most attention (f:7; 30.4%), followed by creative thinking and cognitive skills. This demonstrates that critical thinking is a fundamental focus in P4C research in pre-school settings.

Research findings in the literature also support this conclusion. Daniel, Gagnon, and Pettier (2012) discovered that P4C practices based on philosophical dialogue strengthen children's critical thinking skills and contribute to their understanding of different perspectives. Similarly, Gasparatou and Kampeza (2012) noted that children aged 5-6 who participated in P4C programs showed improvement in critical thinking and that these programs should be implemented in pre-school education.

Erfani and Rezaei's (2016) research showed that P4C significantly increased students' levels of reasoning and critical thinking. Säre et al. (2016) also stated that philosophical group discussions improved children's verbal reasoning skills, particularly showing significant progress in sub-skills such as comparison, analogy, justification, and establishing cause and effect relationships. Studies conducted in Türkiye also support these findings. Karadağ and Demirtaş (2018) as well as Işıklar and Abalı Öztürk (2022) have demonstrated that P4C enhances children's critical thinking skills; Işıklar (2019) has revealed that P4C practices lead to significant improvement in problem-solving skills.

Similarly, Tekkalan et al. (2023) reported that story-based philosophical inquiry is an effective method for supporting the development of critical thinking in children within Turkish language activities. These findings indicate that P4C systematically develops children's skills of questioning, analyzing, and reasoning in early childhood.

Critical thinking skills as well as creative thinking skills are found to be improved through the P4C process. Ghaedi, Mahdian, and Fomani (2015) stated that the P4C program strengthened creative thinking skills in pre-school children and increased creativity indicators throughout the process. Similarly, Mohammadi et al. (2019) and Pekkarakaş (2020) have also found that P4C encourages creativity and leads to a significant increase in children's creative thinking levels. Research by Taş (2017) has shown that P4C contributes to the development of creativity and theory of mind in children, while Karaçelik's (2022) study has demonstrated that digital storytelling-based philosophy programs develop creative and critical thinking.

Cullen (2016) has also stated that P4C contributes to the development of high-level cognitive skills in children and that this finding challenges Piaget's assumption that abstract thinking is not possible at a young age. Demirtaş et al. (2018) stated that P4C programs develop children's skills such as asking questions, presenting reasons, and providing explanations. Akıncı Demirbaş (2022) as well as Işıklar and Abalı Öztürk (2022) have also reported that P4C has led to meaningful improvements in children's problem-solving and decision-making skills. Additionally, studies by Şavşet and Çelebi Öncü (2022) as well as Yıldız (2024) have also demonstrated that P4C supports children's overall cognitive development by enhancing cognitive depth, attention levels, and curiosity.

When these findings are evaluated holistically, it is concluded that P4C has multifaceted and lasting effects on critical thinking, creative thinking, reasoning, problem solving, cognitive flexibility, theory of mind, and high-level cognitive skills in the pre-school period.

There are various experimental studies in the literature showing that P4C practices develop not only children's thinking skills but also their social skills. This study examines the distribution of research on social skills and determines that such studies have begun to emerge in the literature since 2013. However, it is evident that the number of studies in this field is rather limited. As a result of reviewing the limited number of existing studies, it was identified that the most frequently addressed social skill was cooperation skills (f:2; 18.2%), while other social skills were represented in equal proportions (9.1%).

Giménez-Dasí, Quintanilla, and Daniel (2013) have found significant increases in the emotional understanding and social competence levels of children aged 4-5 who participated in P4C practices through the "Thinking About Emotions" program. Similarly, Arda Tunçdemir, Burroughs, and Moore (2022) have found that philosophical ethics practices in early childhood develop empathy, cooperation, and social sensitivity skills.

Studies conducted in Türkiye also support these findings. Karaboğa (2023) stated that the P4C program improved children's listening skills, while Ünal and Güneş (2024) noted that P4C activities had positive effects on the perception of moral and social rules. In the study by Yıldız (2024), it was revealed that P4C contributes not only to cognitive development but also to social-emotional and language development, and that children show an increase in behaviors of communication, sharing, and cooperation. Moreover, Kılıç and Ercan's (2025) study, "Thinking Skills Supportive Education Program (DBDEP)," also found that P4C-based activities significantly improved children's social skills and social problem-solving skills.

When these findings are assessed together, it is evident that P4C has led to remarkable improvements in children's abilities to understand emotions, build empathy, collaborate, communicate, form social relationships, listen, share, and solve social problems.

In conclusion, research on P4C practices in pre-school period indicates that they make significant contributions to children's development in terms of both thinking skills and social skills. However, the limited number of existing studies indicates that this field is still in need of further improvement. Future research should include broader studies on social skills, particularly empathy, understanding emotions, social rules, and social problem solving. Furthermore, the diversification of research subjects will contribute to a more comprehensive understanding of the potential effects of P4C practices on pre-school education.

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Ethical Statement: In this study, I declare that the rules specified in the "Higher Education Institutions Scientific Research and Publication Ethics Guidelines" have been followed and that no actions based on "Behaviors Contrary to Scientific Research and Publication Ethics" have been taken. I also declare that responsibility for all ethical violations lies with the author of the article.

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Can Chatbots Pose Good Math Word Problems?

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Abstract

The integration of artificial intelligence (AI) into mathematics education is increasingly gaining attention due to its potential to support teachers in various aspects of instruction, especially in the creation of teaching materials. One promising area of application is the automatic generation of word problems tailored to specific mathematical structures. This study explores the capabilities of four widely used AI chatbots—ChatGPT, Gemini, Copilot, and DeepSeek—in generating word problems for multi-operation equations. The aim is to evaluate the extent to which these tools can produce mathematically valid and pedagogically appropriate content that aligns with curricular goals. The research focused on three key criteria in evaluating the generated problems: (1) mathematical correctness of the word problems, (2) contextual appropriateness and realism of the scenarios, and (3) consistency between the symbolic structure of the given equation and its corresponding verbal representation. Each chatbot was prompted to generate word problems for a set of predefined equations involving two operations, such as multiplication and subtraction, or division and addition. Findings reveal that all four chatbots were generally successful in generating well-structured and contextually relevant word problems for equations involving multiplication and subtraction. However, a marked decline in accuracy and coherence was observed when the equations included division and addition. In these cases, the word problems often contained inconsistencies between the symbolic and verbal representations, misleading or ambiguous contexts, or incorrect interpretations of the operations involved. Interestingly, the nature of these errors mirrors those identified in previous research conducted by the authors on the performance of pre-service elementary teachers in problem posing. This parallel highlights a potentially deeper issue: current AI tools may inherit or mimic human-like conceptual limitations, particularly regarding the interpretation of mathematical operations and the construction of meaningful contexts. Although AI-generated content holds promise for educational use, especially as a starting point for lesson planning or student practice, this study underscores the importance of human oversight. Teachers must critically evaluate and, if necessary, revise AI-generated materials before integrating them into instruction. Enhancing the capabilities of AI systems to handle more complex mathematical relationships could significantly improve their utility in supporting teachers and advancing problem-posing practices in mathematics education.

Keywords: Artificial intelligence, Mathematics education, Word problem generation, Multi-operation equations, Pre-service elementary teachers.

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Introduction

In mathematics instruction, the greatest attention is most often devoted to solving computational tasks and various mathematical problems. However, in addition to solving computational tasks, mathematical word problems represent an important educational resource that helps assess and strengthen students' understanding of mathematical concepts and skills (Wang, Lan & Baraniuk, 2021). A mathematical word problem is most commonly defined as a text that describes a problem situation in which the solution is reached by performing certain mathematical operations using the given numerical data (Verschaffel et al., 2020). Students should be provided with tasks that involve a certain cognitive demand, are beneficial to them, and are relevant to the content they are expected to master. If such teacher-initiated, stimulating practices are absent, students are prevented from applying higher-order mathematical thinking.

The effectiveness of mathematics instruction largely depends on the strategies teachers apply in working with students and the mathematical tasks they offer them. Considering that, when selecting tasks, teachers most often rely on available mathematics textbooks (Kaur & Lam, 2012), and that there is often a misalignment between the latest curriculum changes and current textbook materials, teachers are forced to transform existing mathematical problems or create new ones themselves. Research has shown that teachers experience difficulties in correctly and mathematically appropriately formulating a task, even when the solving procedure requires only one step. Teachers tend to pose simple mathematical problems with low cognitive demands, typically at the level of basic understanding. When formulating problems, they most often focus on only one aspect of the task, with noticeable logical inconsistencies and a lack of mathematical structure. Sometimes it happens that a task formulated in such a way cannot be solved due to missing necessary information (Chapman, 2012; Fitriana et al., 2022; Leavy & Hourigan, 2020).

Teachers should incorporate a variety of word problems in their instruction, as diversity in problem types plays a significant role in effective mathematics teaching (Ariyarathne et al., 2025). A correctly formulated word problem enables students, through its solution, to learn how to translate various problem situations into mathematical language using appropriate arithmetic operations (Suseelan, Chew & Chin, 2022). If a mathematical problem is not correctly formulated or posed by its creator, it cannot be solved (Masriyah, Kurniasari & Palupi, 2018). For word problems to serve as effective instructional tools, they must be solvable, developmentally appropriate, and yield accurate solutions (Christ, Kropko & Hartvigsen, 2024). Therefore, proper problem posing is crucial for high-quality mathematics instruction (Cai & Hwang, 2020). The mathematical tasks teachers pose shape students' mathematical learning and should be aligned with instructional objectives (Cai & Hwang, 2020). Creating mathematical problems is important for teachers, as they often need to modify existing problems to adapt them to their students' abilities (Baumanns & Rott, 2024). Due to its potential to support teachers in activities involving the formulation of mathematical problems, the integration of artificial intelligence (AI) is receiving increasing attention in research. One aspect of this is the automatic generation of word problems adapted to specific mathematical structures.

In this paper, we investigate the potential of four AI chatbots (ChatGPT, Gemini, Copilot, and DeepSeek) to generate mathematical word problems (WPs) tailored to a specified grade level. The required WPs had to correspond to two multi-operation equations (one involving multiplication and subtraction, the other involving division and addition) and be suitable for fourth-grade primary school students. The aim of our research is to evaluate the extent to which AI chatbots can produce mathematically valid and pedagogically appropriate content. Our research focused on three key criteria: the mathematical correctness of the word problems, the contextual appropriateness and realism of the scenarios, and the consistency between the symbolic structure of the given equation and its corresponding verbal representation.

Literature Review

Klinshtern, Koichu & Berman (2015) define problem posing as the ability of teachers to formulate problems that differ to some extent from those found in textbooks, to formulate problems that students

have not previously encountered, and to formulate problems that can be used to meet instructional needs that would be difficult to satisfy using existing mathematical problems. A teacher must be able to select, modify, create, and pose problems for different educational purposes (Mallart, Font & Diez, 2018).

In their previous study, the authors examined the extent to which pre-service teachers are able to formulate mathematical word problems with a real-world context based on given equations (Mihajlović, Vulović & Milikić, 2025). The study participants were tasked with creating two word problems corresponding to two equations, one involving multiplication and subtraction and the other involving division and addition. The analysis revealed that pre-service teachers had difficulties translating complex equations (equations containing more than one operation) into mathematically correct word problems. Most participants were successful in formulating problems corresponding to the equation involving multiplication and subtraction, while they were less successful in formulating a word problem for the equation involving division and addition. Their primary focus was on the mathematical accuracy of the formulated word problems. When composing the text of the problems, everyday language often predominated over mathematical language, resulting in a lack of the precision required for mathematical tasks. The authors related these findings to results from other studies, which also showed that pre-service teachers frequently generate poorly formulated word problems with insufficient information (Kadir et al., 2020; Kohar, Rahaju, & Rohim, 2022). Another evaluation criterion was the realism of the context, which also proved to be a challenging requirement for participants. Although the themes of the formulated problems were drawn from everyday life, the numerical values used in the tasks were not realistically possible.

On the other hand, the majority of studies aimed at examining the effectiveness of chatbots focus on determining the extent to which AI tools can correctly solve a given mathematical problem. Dahal et al. (2023) evaluated AI chatbots (Google Bard, ChatGPT, Bing Chat, and Wolfram Alpha) as problem solvers for math algorithms for learners and teachers from primary school to university. According to the authors, challenges for AI chatbots include their limited understanding of natural language models and prompt engineering, as well as their inability to solve complex mathematical problems. A similar study evaluating the capabilities of three chatbots—ChatGPT-3.5, ChatGPT-4, and Google Bard—was conducted by Plevris, Papazafeiropoulos, and Jiménez Rios (2023). Using a set of 30 mathematical and logical questions, the authors investigated the extent to which chatbots were able to understand a given problem, use appropriate algorithms or methods to solve it, and generate responses with correct answers. The findings indicate that chatbots can provide correct solutions for simple arithmetic, algebraic expressions, and basic logical puzzles; however, their responses to more complex mathematical problems or advanced logical tasks are unreliable. The results showed that ChatGPT-4 performed better than ChatGPT-3.5, while Bard ranked third, lagging behind the other two chatbots.

A group of authors examined the performance of various chatbots on non-standard mathematical problems from different mathematics competitions. In one of their studies, they analyzed the performance of the AI Math Solver in solving tasks from the 2024 Kangaroo competition (Stanković et al., 2025). They used problems intended for students in grades 3 and 4 of primary school, grades 7 and 8 of primary school, and grades 3 and 4 of secondary school. The results showed that AI solved only 24 out of 84 tasks completely correctly, which was significantly below expectations. The authors noted that although it was expected that performance would decline as task difficulty increased, the results showed that AI had difficulties even with problems intended for 3rd- and 4th-grade primary school students. Svičević et al. (2025) analyzed tools such as ChatGPT-free, ChatGPT-paid, AI Math Solver, Math Mentor, and o1-preview, evaluating their efficiency in solving problems of varying levels of difficulty and from different areas. The results showed that among the chatbots tested, o1-preview stood out in terms of accuracy. All tools used in the study demonstrated the highest efficiency in solving tasks involving numbers and algebra, while they were least effective when solving geometric and logical problems.

In this paper, we examine the ability of chatbots to formulate appropriate mathematical word problems with a real-world context based on given equations. Such problems enable learned mathematical concepts to be connected with their application in the real world (Verschaffel, Depaepe & Van Dooren, 2014). To solve these problems, students must reflect and develop the skills needed to recognize when

and how to effectively apply their mathematical knowledge in various problem situations encountered in everyday life.

Method

Our study examines the capabilities of four widely used AI chatbots—ChatGPT, Gemini, Copilot, and DeepSeek—in generating word problems for multi-operation equations. The aim was to evaluate the extent to which these tools can produce mathematically sound and pedagogically appropriate content that aligns with curriculum expectations.

Research question: *Can chatbots provide teachers with additional support in generating high-quality math word problems?*

The investigation focused on three key criteria: (1) the mathematical correctness of the generated problems; (2) the contextual appropriateness and realism of the scenarios; (3) the consistency between the symbolic structure of the given equation and its verbal representation. Christ, Kropko and Hartvigsen (2024) similarly used three evaluation dimensions: solvability (problems can be solved and have a single correct answer), accuracy (the tasks are mathematically correct), and appropriateness (the scenarios make logical sense, contain no grammatical errors or contradictory information, and are both mathematically and contextually suitable for students).

Each chatbot was prompted to generate word problems for a predefined set of equations involving two operations, such as multiplication and subtraction or division and addition. All tests were conducted in July 2025, and all chatbots received identical prompts:

Generate a math word problem with a real-life context that corresponds to the following equations:
$1000 - 5 \cdot x = 700$
$x \div 10 + 230 = 470$.
The problems should be appropriate for 4th-grade elementary school students.

Findings

The initial prompts followed a zero-shot prompting strategy. We analyzed the WPs produced by the four models to identify the types of errors occurring during word-problem generation. Table 1 presents the WPs generated for the first equation.

Table 1.
Word-problems Corresponding to the First Equation

AI tool	First Equation ($1000 - 5 \cdot x = 700$) text
ChatGPT	Marko had 1000 dinars. Every day he spent the same amount of money, for exactly 5 days in a row. In the end, he had 700 dinars left. How many dinars did he spend each day?
Gemini	In a toy store, at the beginning of the day, there were 1000 balloons. During the day, 5 packs of balloons were sold, with each pack containing the same number of balloons. At the end of the day, 700 balloons remained. Question: How many balloons were in one pack?
MS Copilot	In a bank, there were 1000 banknotes. Each day, the same number of bundles of banknotes were taken out, with each bundle containing 5 banknotes. After several days, there were only 700 banknotes left in the bank. For how many days were banknotes taken out of the bank?
DeepSeek	Milan saved 1000 dinars. He decided to buy several toys at the price of 5 dinars each. After the purchase, he had 700 dinars left. How many toys did Milan buy?

For the word problems corresponding to the second equation (involving division and addition), the results were particularly noteworthy. Table 2 shows the WPs generated for the second equation.

Table 2.

Word-problems Corresponding to the Second Equation

AI tool	Equation 2 ($x \div 10 + 230 = 470$) text
ChatGPT	Ivana read a book that had a total of x pages. On the first day, she read one tenth of the book, and on the second day another 230 pages. In the end, she finished the whole book. How many pages does the book have?
Gemini	Marija was collecting stickers. When she divided the number of stickers she had into 10 equal parts and then added 230 more stickers, she had a total of 470 stickers. Question: How many stickers did Marija have at the beginning?
MS Copilot	A factory produced a certain number of bottle caps. One tenth of that number was sent to stores, and then another 230 caps were added from an old stock. Now the factory has a total of 470 caps. How many caps did the factory originally produce?
DeepSeek	Ana had an unknown number of stickers. She gave one tenth of those stickers to her friend, and then she bought 230 more stickers. In the end, she had a total of 470 stickers. How many stickers did Ana have at the beginning?

Discussion, Conclusion, and Suggestions

All four chatbots produced **solvable** and **mathematically correct** word problems corresponding to the first equation. However, regarding contextual appropriateness and realism, the WPs generated by ChatGPT and Gemini were suitable, whereas those produced by MS Copilot and DeepSeek were only partially appropriate. Although the latter two included real-life contexts, their numerical values were unrealistic (e.g., the number of banknotes in a single bundle or the price of toys).

A similar pattern was observed in the consistency between the symbolic structure of the equation and its verbal description. ChatGPT and Gemini maintained consistency, whereas MS Copilot and DeepSeek incorrectly switched the roles of the first and second factors.

On the other hand, none of the four AI chatbots generated a correct word problem corresponding to the second equation. Although all scenarios were realistic, some numbers were unrealistic within the given context (e.g., a girls collecting around 2,400 stickers, which is highly improbable). In all cases, the consistency between the equation and its verbal form was lacking. ChatGPT's output omitted certain essential data (e.g., the value 470) while including redundant information. Additionally, none of the generated texts clearly indicated that only one part (one-tenth of the unknown value $\boldsymbol{x}$) was considered. Similar issues were reported by Ariyarathne et al. (2025).

The nature of the chatbots' errors mirrors those identified in previous research conducted by the authors on the performance of pre-service elementary teachers in problem posing (Mihajlović, Vulović, & Milikić, 2025). This parallel suggests a deeper issue: contemporary AI tools may inherit or resemble human-like conceptual limitations, particularly in interpreting mathematical operations and constructing meaningful contexts.

When provided with an example of a correctly formulated word problem for the second equation (in addition to the prompt), the chatbots were able to generate correct word problems independently. This indicates that human evaluation remains essential for determining the correctness and suitability of AI-generated problems. Ariyarathne et al. (2025) similarly observed that incorporating human feedback improves the quality of generated tasks. Additional prompting in the form of examples (i.e., one-shot or few-shot prompting) can enhance a chatbot's output (Singh & Namin, 2025). Such examples offer explicit patterns for the model to follow, reducing ambiguity and improving accuracy and consistency.

The findings of the study indicate several recognized strengths and weaknesses of AI models in generating mathematical word problems. All the chatbots examined (ChatGPT, Gemini, Copilot, and DeepSeek) successfully formulated mathematically correct problems when the target equation involved multiplication and subtraction, demonstrating their ability to create contextually appropriate and logically coherent tasks. It was also confirmed that the quality of their formulations improves when the

models are guided in advance with an appropriate example, highlighting their reliance on the structure and quality of input and confirming that well-designed prompts can enhance the reliability of generated content. Another advantage lies in their ability to quickly produce multiple problem variants, making them a useful tool for preparing differentiated instruction.

However, significant limitations were observed when it was necessary to generate more complex relationships expressed simultaneously through division and addition operations. These limitations included inconsistencies between the mathematical structure and the verbal description, unrealistic numerical values, logically incoherent situations, and deviations from the correct interpretation of operations. Notably, the types of errors made by the AI models were identical to those identified among pre-service teachers, indicating that contemporary models do not overcome dominant human conceptual weaknesses but often replicate them. This suggests that AI cannot function as an independent creator of didactically correct problems, and its outputs necessarily require expert review and correction.

Overall, AI chatbots represent a useful but non-representative and unreliable source for formulating mathematical word problems without teacher supervision. They can significantly accelerate the preparation of materials, expand the set of problem situations, and serve as a means to develop critical thinking in future teachers, particularly through the analysis and correction of AI errors. Nevertheless, their use must be accompanied by careful pedagogical evaluation, as imprecisely formulated tasks may hinder students' understanding of mathematical concepts. This study confirms that AI should be regarded as a support tool rather than a substitute for teacher expertise, and that appropriate guidance through examples and clearly defined instructions is key to obtaining higher-quality and pedagogically applicable AI-generated outputs.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Institutional Review Board Statement: The research does not require ethical approval.

Data Availability Statement: Researchers may request access to the study data by contacting the corresponding co-author.

Conflict of Interest: There is no conflict of interest.

Generative Artificial Intelligence Statement: Artificial intelligence tools (ChatGPT, Gemini, Copilot, and DeepSeek) were utilized solely for generating word problems related to the multi-operation equations and for proofreading textual content; all analytical and interpretive aspects of the research were carried out by the authors.

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PISA 2022 Turkey Data on the Effect of Types of Books at Home on Students' Reading Proficiency: Correlation and Bayesian Network Analysis

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Abstract

This study aims to examine the influence of the number of classic literature books and supplementary textbooks available in students' homes on their reading proficiency using PISA 2022 Turkey data. Based on the assumption that classic literature books signify the presence of a broader reading culture, while supplementary textbooks primarily represent an exam-oriented learning environment, this study investigates how different book types relate to reading proficiency through correlation analysis and a Bayesian network using the Tree-Augmented Naive Bayes (TAN) model. The study sample comprised 5,388 Turkish students who participated in PISA 2022 and had complete data for the relevant variables. Reading proficiency was calculated by averaging ten plausible values and subsequently categorizing students into "Insufficient" and "Sufficient" groups using the national mean score of 456 as the threshold. The independent variables, representing book types, were coded according to their original PISA questionnaire categories: "None," "1–5," "6–10," and "More than 10". Correlation analysis revealed statistically significant positive relationships between both book types and reading proficiency levels. A moderate positive correlation was found between the number of classic literature books and reading proficiency ($r = 0.401$), while a weaker yet significant correlation was found for supplementary textbooks ($r = 0.344$). The TAN model provides a deeper insight into the conditional dependency structure among variables. The findings demonstrated that classic literature exerted the strongest and most direct influence on reading proficiency. Furthermore, the model indicates that the presence of classic books increases the likelihood of having supplementary textbooks at home, reflecting a broader reading culture. Scenario analyses supported these results: students with more than ten classic literature books but no supplementary textbooks had a 63% probability of demonstrating reading proficiency, whereas those with more than ten supplementary textbooks but no classic literature books had only a 34% probability of demonstrating reading proficiency. These results highlight that the type of books at home, rather than their sheer quantity, plays a decisive role in reading outcomes. Ultimately, the findings underscore the importance of fostering a rich reading culture at home as a foundation for enhancing students' reading proficiency and supporting independent-learning processes.

Keywords: PISA 2022, reading proficiency, artificial intelligence, Bayesian network, classic books.

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Introduction

In today's information society, the rapid development of artificial intelligence has made independent learning skills more important than ever. Artificial intelligence stands out not only as a tool for transferring information but also as a means of personalizing learning experiences (Li & Lin, 2025). Therefore, individuals' ability to interact with artificial intelligence is essential for success in the competitive educational environment of the information society.

Reading proficiency is the foundation of independent learning. Reading proficiency critically impacts individuals' ability to access information and manage their learning processes, equipping them with the skills to understand, analyze, and create opportunities to learn from texts (Mubarok & Sofiana, 2017).

Research has shown that reading skills positively impact learning motivation and independent-learning. For example, Mubarok and Sofiana (2017) reported a significant relationship between reading motivation and student achievement, while Lau and Ho (2015) revealed that reading performance is directly related to students' self-regulated learning skills.

Reading proficiency guides individuals in evaluating and analyzing information. Robbrecht et al. (2023) state that individuals with well-developed reading skills are more effective in complex learning environments. Teng and Zhang (2021), on the other hand, emphasize that the metacognitive knowledge provided by reading skills enables students to have greater control over their own learning processes and to manage these processes efficiently.

One of the most important tools for comprehensively measuring students' critical reading proficiency is the Programme for International Student Assessment (PISA). The aim of PISA is to assess students' abilities to read, understand, and apply new information; thus, it provides a framework based on the ability to adapt to new knowledge and lifelong learning in the age of artificial intelligence (Sholihah et al., 2023; Suryani et al., 2021).

In addition to these assessments, PISA conducts various surveys to understand the environmental factors affecting student achievement. Among these surveys are questions about the types and numbers of books available in students' homes (ST256Q01JA–ST256Q10JA) (OECD 2024). Yarım and Bedirhanoğlu (2021) note that in studies such as PISA and TIMSS, there is a positive relationship between the number of books at home and students' academic achievements. Similarly, Zahavi et al. (2019) revealed that the number of books at home has a significant effect on PISA reading performance, while Yalçın and Bayraktar (2022) demonstrated that as the number of books at home increases, reading achievement also increases. Therefore, these surveys provide important data for a deeper examination of the role of reading proficiency in independent-learning processes.

Although existing studies consistently highlight the importance of home resources for students' academic success, the literature offers limited insight into how specific categories of books contribute differently to reading proficiency. In particular, research has rarely distinguished between classic literature—which may signify a broader and more enduring reading culture—and supplementary textbooks, which tend to reflect a test-oriented learning atmosphere. This lack of differentiation leaves an important gap in understanding the qualitative nature of home literacy environments. Addressing this gap, the present study focuses on the distinct roles of these book types in shaping students' reading proficiency.

Purpose of the Study

This study aimed to examine in depth how the number of classic literature books and supplementary textbooks available in students' homes relates to their reading proficiency by employing both correlation analysis and a Bayesian network (TAN model) using PISA 2022 Turkey data. Beyond merely identifying statistical associations, the study sought to uncover the structural and probabilistic patterns underlying these relationships. The analysis was grounded in the assumption that classic literature books signify the presence of a broader and sustained reading culture within the family environment, whereas supplementary textbooks primarily represent a learning atmosphere centered on exam preparation and instructional support. Based on these conceptual distinctions, the study addressed the following research

questions:1. Is there a significant relationship between the number of book types at home and reading proficiency

2. What kind of probabilistic relationship structure has the Bayesian network model established between the types of books at home and reading proficiency

3. In scenario analyses, under which conditions does reading proficiency increase?

Method

Research Design and Study Group

This study was a descriptive relational survey based on a quantitative data analysis. The data source of the study consisted of data collected from Turkey in the 2022 cycle of the Programme for International Student Assessment (PISA). The study group comprises a total of 5,388 students aged 15 from the PISA 2022 Turkey sample with no missing data regarding the analyzed variables. Of the sample, 49.4% were female, and 50.6% were male.

Data Collection Tools and Processing Procedure

Data were collected through the reading test and student questionnaire forms used in PISA 2022. The following data processing steps were followed during the analysis.

1. Creation of the Reading Proficiency Variable: For each student, a single reading score was calculated by taking the arithmetic mean of 10 different reading scores (plausible values [PV]) representing their reading performance. This continuous score was classified into two meaningful and balanced categories using the PISA 2022 Turkey average score of 456 as a threshold value. Students who scored below this value were coded as "Insufficient," while those scoring at or above this value were coded as "Sufficient," and the dependent variable was defined through this dichotomous structure.

2. Coding of Independent Variables: The two independent variables of the study (ST256Q02JA and ST256Q10JA) were coded in accordance with their original format in the PISA questionnaire as categorical: "None," "1-5," "6-10," and "More than 10."

Data Analysis

Data analysis was conducted in two stages to answer the research questions.

1. Correlation Analysis: To Spearman correlation coefficient was calculated to examine the direction and strength of the relationships between variables, considering the categorical (ordinal) nature of the variables. This analysis provided a preliminary overview of the relationship between independent variables and reading proficiency.

2. Bayesian Network Analysis: To model complex conditional dependency structures among variables, a Bayesian Network was developed using the tree-augmented naive Bayes (TAN) algorithm. The analyses were conducted using GeNIe Modeler software.

- Algorithm Selection and Rationale: The TAN algorithm relaxes the strict assumption of the basic Naive Bayes classifier that each attribute depends only on the class variable and is independent of the others. The TAN structure, when conditioned on the class variable, allows additional connections between attributes, thereby providing the capacity to model statistical dependencies in the data in a more flexible and realistic manner (Jing and Zhang, 2008). The network structure was automatically generated through structural learning from data.

- Model Performance: The predictive performance of the constructed TAN model was evaluated, and the overall classification accuracy of the model was 68.6%. The area under the curve (AUC), which measures the discriminative power of the model, was 0.74. Additionally, to confirm the reliability and prediction calibration of the model, a calibration plot showing the agreement between the predicted probabilities and observed outcomes was examined, and the model was verified to be reliable.

Findings

The findings obtained as a result of the data analysis process of the research are summarized below: Findings from the Correlation Analysis Spearman's correlation analysis was conducted to examine the

strength and direction of the relationship between variables, revealing that both types of books showed statistically significant positive correlations with reading proficiency. Accordingly:

- A moderate positive relationship was found between Classical Literature Books and reading proficiency (r = 0.401).

- A lower yet significant positive relationship was detected between Supplementary Textbooks and reading proficiency (r = 0.344).

Findings from the Bayesian Network (TAN Model)

Following the correlation analysis, the Tree Augmented Naive Bayes (TAN) model, designed to better model the causal structure between variables, provided deeper and more structural findings than the other models.

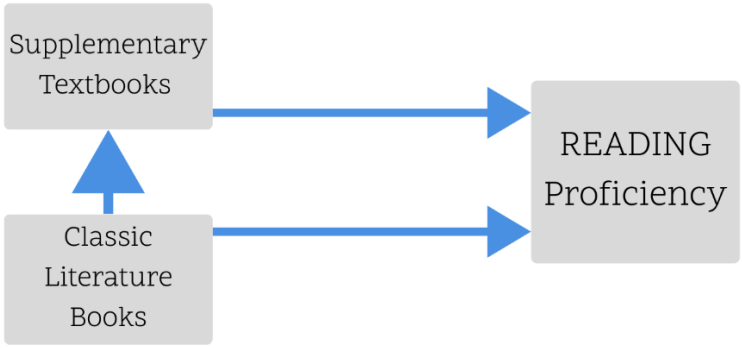


Figure 1. *Bayesian Network Model between book genres and reading proficiency*

As shown in Figure 1, the model shows that classic literature books present in students' homes play a direct and strongest role in determining reading proficiency. Even more strikingly, the network structure that emerged through data learning revealed that classic literature books have a decisive effect on reading proficiency and the presence of supplementary texts. This finding can be interpreted as indicating that classic literature lies at the center of a broader reading culture, which also stimulates interest in academic resources.

The scenario analyses performed on the model illustrated this effect.

- Scenario 1: If a student has more than 10 classic literature books at home but no supplementary textbooks, the probability of the student demonstrating reading proficiency is 63%.

- Scenario 2: In contrast, if a student has more than 10 supplementary textbooks at home but no classic literature books, the probability of reading proficiency decreases to 34%.

This result indicates that the type of books present at home is critically important, rather than the number of books present. The scenario analyses also indicated that increases in the number of classic literature books consistently raised the predicted probability of reading proficiency across all conditions. In contrast, increases in supplementary textbooks did not produce similar changes when classic literature books were absent.

Discussion, Conclusion, and Suggestions

The The findings of this study provide a multidimensional perspective on how different types of books available in students' homes relate to reading proficiency. The results obtained from both the correlation analysis and the Bayesian network (TAN) model reveal that classic literature books demonstrate a stronger association with reading proficiency than supplementary textbooks. This pattern was consistent across all scenarios generated by the model, suggesting that the distinction between book types carries meaningful predictive value. The scenario analyses further reinforced these results by showing that substantial increases in reading proficiency were observed only when classic literature books were present, regardless of the number of supplementary textbooks.

These findings align with prior research indicating that home literacy environments significantly contribute to students' academic outcomes (Yarım & Bedirhanoğlu, 2021; Zahavi et al., 2019; Yalçın & Bayraktar, 2022). However, the present study extends the literature by differentiating between book categories rather than relying on an aggregate "number of books at home" indicator frequently used in PISA-related studies. The differentiation between classic literature books and supplementary textbooks highlights that the qualitative nature of reading resources is a critical factor. This contribution represents a conceptual advancement in understanding home learning environments, as most previous studies have treated books as a homogeneous resource.

An additional contribution of this study lies in the Bayesian network model's structural findings. The TAN model identified classic literature books as a central node with direct influence not only on reading proficiency but also on the likelihood of having supplementary textbooks at home. This structural pattern suggests that families who maintain a strong reading culture are also more likely to invest in academic resources, whereas the reverse does not hold: students with numerous supplementary textbooks do not necessarily come from homes enriched with classic literature. The data-driven dependency structure therefore illuminates the hierarchical nature of home literacy environments, positioning classic literature as a foundational component within this hierarchy.

The model's scenario analyses deepen these insights by demonstrating that increases in supplementary textbooks do not substantially raise the probability of reading proficiency in the absence of classic literature books. This asymmetric pattern indicates that supplementary textbooks alone do not provide the type of cognitive stimulation necessary for developing higher-order reading skills. In contrast, classic literature books appear to contribute more directly to the development of metacognitive awareness, deep comprehension, and sustained reading engagement—competencies that PISA assessments heavily emphasize.

Several plausible explanations can be derived to interpret these findings. Classic literary works typically contain complex narrative structures, diverse vocabulary, and multilayered meanings. Exposure to such texts may help students develop stronger inferential reasoning, critical evaluation, and text-integration skills, which are central components of reading proficiency as measured by PISA (Robbrecht et al., 2023; Teng & Zhang, 2021). Moreover, classical texts often require readers to navigate dense linguistic and conceptual content, strengthening working memory and cognitive flexibility (Daneman & Merikle, 1996; Chein & Morrison, 2010). In contrast, supplementary textbooks generally prioritize procedural knowledge and exam-focused content, which may support academic achievement but do not offer comparable opportunities for deep cognitive engagement.

From an educational policy perspective, the results underscore the importance of cultivating rich and diverse home literacy environments that extend beyond exam-oriented materials. Encouraging families to introduce children to classic literature may have long-term benefits not only for reading proficiency but also for independent learning skills, which are increasingly essential in AI-mediated educational contexts. Schools and libraries also play an important role in facilitating equitable access to high-quality literary resources, especially for students who may lack such materials at home.

In conclusion, the study demonstrates that the type of books available in students' homes plays a meaningful and differentiated role in predicting reading proficiency. Classic literature books, in particular, emerge as a key component of home literacy environments that support higher-level reading skills and independent-learning abilities. These results provide a valuable framework for educators, policymakers, and researchers seeking to enhance students' reading development through targeted literacy interventions and resource investments.

Acknowledgment

Ethics statement: I declare that in this study, the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" have been complied with and that no action has been taken within the scope of "Actions Contrary to Scientific Research and Publication Ethics."

Institutional Review Board Statement: This study was conducted using anonymous and publicly available PISA 2022 data provided by OECD. As the dataset did not contain personally identifiable

information, ethical committee approval was not required for this study. The research process was consistent with the ethical principles of science.

Data Availability Statement: The data are publicly available and accessible PISA 2022 data from the OECD website.

Conflict of Interest: The study was conducted by a single author, and no conflicts of interest were reported.

Generative Artificial Intelligence Statement: Generative artificial intelligence tools were used solely to support the literature review process and to refine the stylistic clarity of the manuscript. No AI-generated content was used to produce, analyze, or interpret the research data.

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Media Literacy and Critical Thinking in the Age of AI: Preparing Students in the Classroom

Desislava Kracholova [1]

Abstract

In the context of accelerated digitalization and the pervasive adoption of Artificial Intelligence (AI), media literacy and critical thinking are defined as key competencies required for students' successful social integration and educational attainment. The digital environment provides a wide spectrum of opportunities for knowledge access, but simultaneously exposes young people to the risks of disinformation, algorithmic bias, and manipulative media messages. This necessitates the development of skills for critically evaluating sources, interpreting content, and making informed decisions as fundamental elements of the educational process.

The present study analyzes the significance of media literacy and critical thinking at school age and investigates effective pedagogical practices that support their development. A qualitative analysis of contemporary educational strategies was employed, along with a review of current scientific literature related to teaching these competencies in the context of AI-driven information systems. The results indicate that an interdisciplinary approach, working with real-world media case studies, and ethical discussions contribute significantly to fostering critical engagement among students.

The findings from the research demonstrate that the integration of media literacy and critical thinking as transversal skills is a core competency for preparing students for participation in contemporary digital society and for increasing their digital resilience.

Keywords: media literacy, critical thinking, artificial intelligence (AI), digital devices, educational strategies

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Introduction

In the age of Generative artificial intelligence (AI) and algorithmic content, students' ability to distinguish fact from fiction is increasingly at risk. Accelerated digitalization and the proliferation of AI recommendation systems are radically transforming the way young people search for and process information, exposing them to heightened risk from disinformation, algorithmic bias, and manipulative media messages. This dynamic necessitates a transformation in traditional pedagogical practices. Consequently, it is imperative for students to acquire media literacy and critical thinking as significant competencies for successful educational and social participation.

The traditional and widely adopted definition, popularized by scholars such as Aufderheide (1993) and Christ & Potter (1998), focuses on four core skills: access, analysis, evaluation, and creation of messages. These four components form the foundation of many educational programs, as they are considered interconnected and support the dynamic learning process (e.g., the reciprocal relationship between production and reception, where personal content creation increases the critical understanding of professionally produced messages). Despite its applicability, this framework often proves insufficient to address the complexity of the contemporary media ecosystem. In the context of AI, these skills gain a new dimension: students need to understand the mechanisms of filter bubbles, how automated personalization systems operate, and how personal data influences information flows. Critical thinking, in turn, represents a cognitive process for analyzing arguments, recognizing logical fallacies, and constructing well-reasoned conclusions. These two competencies are interconnected and mutually reinforcing, and their integration into the educational process is crucial for counteracting cognitive biases and forming informed beliefs.

Contemporary students face challenges such as fake news, deepfakes, and algorithmic visibility. This necessitates the school playing a leading role in their preparation. Pedagogical practices aimed at developing these skills include interdisciplinary approaches, analysis of real-world media case studies, project-based learning, and ethical discussions. Despite the growing body of research dedicated to media literacy (e.g., Christ & Potter, 1998; Jeong et al., 2012), there is a lack of a systematic review of effective pedagogical practices that purposefully integrate the development of critical thinking specifically within the context of AI and digital resilience. The present article aims to provide a critical analysis of effective pedagogical practices, thereby contributing to the systematization of knowledge on the topic and outlining guidelines for integrating critical thinking in the classroom, specifically in the context of AI and digital resilience, without claiming to be exhaustive, as these processes are dynamic and require ongoing updating themselves.

The objective of the current study is to analyze the significance of media literacy and critical thinking for students in technologically advancing environments and to outline the leading trends and effective educational approaches for their development. To achieve this goal, the article is structured as follows: First, the theoretical framework of media literacy and critical thinking in the age of AI is presented. Second, the article provides a systematic overview of effective pedagogical practices. Finally, the main challenges faced by teachers are discussed, and recommendations for the integration of these transversal skills in the classroom are formulated.

Literature Review

In the contemporary digital environment, characterized by information overload, accelerated technological transformations, and the increasing role of Artificial Intelligence (AI), the necessity for developing media literacy and critical thinking among young people is becoming ever more salient. Students in the lower secondary school stage are particularly vulnerable to manipulative content, disinformation, and algorithmic filter bubbles, which restrict their access to diverse perspectives. The present research is grounded in the concepts of media literacy (Buckingham, 2003; Hobbs, 2010), critical thinking (Paul & Elder, 2006), algorithmic literacy (Knobel & Lankshear, 2018), and the notion of post-truth (McIntyre, 2018), examining them through the lens of cultural and critical theories (Hall, 1980; Berger & Luckmann, 1996; Giddens, 1991; Castells, 2009).

Media literacy as an educational and social necessity

Core concepts and development

Media literacy is viewed not merely as a set of technical skills, but as the ability to critically perceive, analyze, and create media content (Buckingham, 2003). Hobbs (2010) emphasizes that media functions within a broad socio-cultural context, which requires students to understand not only the structure and format of media messages but also the motives, interests, and power relations behind them. Over the past decades, media literacy has been established as a social and civic competence, enabling individuals to recognize ideological suggestions, interpret media structures, and participate actively in the democratic process (Aufderheide, 1993; Kellner & Share, 2007; Christ & Potter, 1998).

Sociological dimensions

From a sociological perspective, knowledge is formed through social processes and institutional structures, among which the media occupy a central place. Berger and Luckmann (1996) view media as primary agents in the construction of 'reality,' which legitimize certain interpretations as objective. In this sense, media literacy represents a tool for the deconstruction of ideological messages, the uncovering of hidden mechanisms of power, and the development of autonomous thinking. Castells (2009) further elaborates on this perspective, defining contemporary society as a 'network society,' where control over information transforms into a form of social power.

Critical thinking as a social and cognitive competence

Paul and Elder (2006) define critical thinking as the process of argumentation, evidence evaluation, and recognition of cognitive and logical fallacies. In the context of the media environment, this skill is manifested through the ability to avoid accepting information at face value, especially when it originates from opaque or automated algorithmic systems. Giddens (1991) highlights that in conditions of late modernity, individuals are compelled to constantly reflect on social reality in order to navigate complex, dynamic, and often contradictory information environments. Thus, critical thinking acquires the status of a social practice necessary for dealing with manipulation, ideological dependencies, and digital uncertainty.

Critical pedagogy and understanding information messages

Critical pedagogy provides additional dimensions to media and algorithmic literacy. According to Freire (1970), education is a process of "decoding the world," in which students must be empowered to understand and interpret social structures, rather than perceiving them passively. In the digital context, this means developing sensitivity to power practices, algorithmic bias, and hidden mechanisms of influence.

Parallel to this, constructivist approaches (Vygotsky, 1978; Bruner, 1996) view learning as a social process of collaborative knowledge construction. This is especially relevant to media literacy education, where students analyze real-world case studies, exchange interpretations, and build critical reflection within an environment of collective interaction.

Media ecology (McLuhan, 1964; Postman, 1985) extends this analysis, emphasizing that media do not merely transmit content but transform the way we think, learn, and communicate. Under AI conditions, this means students must understand not only the information messages but also the architectures that shape them—interfaces, algorithms, platforms, and digital systems.

Algorithmic literacy and the challenges of "Post-Truth"

Algorithmic literacy involves understanding how algorithms filter and personalize information, often in a non-transparent manner (Knobel & Lankshear, 2018). In the era of "post-truth," where emotional reactions prevail over facts (McIntyre, 2018), these skills acquire an existential character. Students must be able to recognize manipulative practices, generative texts, deepfake materials, and other forms of digital and cognitive manipulation.

Artificial intelligence and new forms of manipulation

AI is radically changing the media ecosystem through generative models (e.g., ChatGPT, GEMINI, Midjourney), recommendation algorithms, synthetic imagery, and automated bots (Hao, 2023; Vincent, 2023). Students become particularly vulnerable to new types of manipulation, including influencer

influence, sensational news, pseudoscientific content, and algorithmic isolation (Marwick & Lewis, 2017; Tandoc et al., 2018).

National context: Bulgaria

A systematic and consistent program for media and algorithmic literacy training is still lacking in Bulgaria. Although media literacy is included in civic education in regulatory documents, the focus is predominantly technical, without developing the critical component (MON, 2022). The project "Digital and Media Literacy Laboratory" demonstrates positive examples of integrating these skills into school practice, including training in safe online behavior, critical thinking, and teamwork.

The Media Literacy Index (2023) ranks Bulgaria 35th out of 41 European countries, confirming the need for more systemic educational policies. Research by "Education without Backpacks" (2023) shows that over 70% of teachers do not feel prepared to use AI in the classroom, which further complicates the introduction of media and algorithmic analysis into education.

Education as social protection

UNESCO defines media and information literacy as a fundamental human right and a key resource for democratic participation. Media education is viewed as a form of social protection that guards young people from manipulation, cognitive biases, and harmful content (UNESCO, 2021). European institutions emphasize that schools play a central role in developing the capacities for independent thinking, critical analysis, and responsible content creation (EUR-Lex, 2021).

Furthermore, the monograph "Critical Thinking and Media Literacy in the Information Society" (Erasmus+, 2024) emphasizes the necessity for students to acquire an understanding of algorithmic interference, the mechanisms of AI, and the possibilities through which technologies can generate, manipulate, or disseminate media messages.

This framework allows us to operationalize media literacy and critical thinking as interconnected variables necessary for counteracting digital manipulation, which will be empirically tested in the subsequent section.

Research hypotheses and question

Based on the presented theoretical framework, which views media and critical thinking as a protective mechanism against algorithmic and post-truth phenomena, the present study aims to empirically verify whether there are statistically significant differences in the self-assessment of media literacy and the recognition of deepfake content between lower secondary school students (girls and boys) in Bulgaria.

With regard to this aim, the following research hypotheses and question are formulated:

- It is hypothesized that boys will demonstrate a statistically significantly higher self-assessment of their media literacy compared to girls.
- It is hypothesized that no statistically significant difference will exist in the ability to recognize deepfake content between girls and boys.

The research question posed by the study is: Is there a statistically significant relationship between the self-assessment of media literacy and the actual ability to recognize deepfake content among the studied group of students?

Method

1. Methodological framework

1.1. Relevance and aims:

In the context of a dynamically developing digital environment and the rapid adoption of Generative AI in the educational process and daily life, the need for the targeted development of media literacy and critical thinking among students acquires strategic significance.

The primary objective of the present empirical study is to analyze and compare the attitudes, skills, and awareness of lower secondary school students regarding key aspects of media literacy and their readiness

for critical orientation in the age of AI. The study involves two classes—50 students—from a specialized Natural Sciences and Mathematics High School.

Research Hypothesis:

Lower secondary (Seventh-grade) students demonstrate a high degree of digital exposure and confidence in their skills, but this self-assessment does not always correspond with their actual conceptual preparedness and critical awareness, particularly concerning Artificial Intelligence-generated content.

1.2. Object, Scope, and Instrumentation:

- **Object of study**: Seventh-grade students (age 13), who are at the end of the lower secondary stage and have intensive contact with digital media and tools.
- **Research sample (N):** The study was conducted using a convenience non-probability sample of a total of 50 students from a natural sciences and mathematics profile, divided into two groups for comparative analysis by gender:

  Boys: n=28

  Girls: n=22

- **Instrumentation:** An original structured anonymous questionnaire (survey) was used, consisting of 18 questions (closed, Likert scale, and semi-open), grouped into four main modules: Digital Profile and Interests; Media Literacy and Verification; Knowledge and Attitude toward AI; and Self-Assessment and School Preparation.
- **Procedure:** The survey was conducted in September 2025 at PPMG "Geo Milev" – Stara Zagora. Full anonymity was ensured. The results were processed using statistical analysis (Excel), presented through frequency distributions and comparative percentage ratios.

Findings

2. Research Results: Comparative analysis by Gender

This section presents the quantitative results obtained from the survey, without interpretation.

2.1. Interests and Digital Profile

Topic of Interest	Boys (n=28)	Girls (n=22)
Social Media	50%	54.5%
Mathematics	57%	45.5%
Informatics/Programming	39%	27.3%
Reading and Writing	21%	27%

2.2. Media Literacy and Attitude toward Information

Indicator	Boys (n=28)	Girls (n=22)
Daily use of the internet for information/news	79%	63.6%
Check sources when encountering online news	43%	54.5%
Self-assessment: Ability to distinguish fake news	71%	45.5%
Clearly recognize the media's influence on people	50%	81.8%

2.3. Artificial Intelligence: Knowledge, Attitudes, and Usage

Indicator	Boys (n=28)	Girls (n=22)
Regular use of AI tools (chatbots, etc.)	86%	63.6%
Self-assessment: Understand the functioning of AI	71%	45.5%
Evaluate AI as a useful study aid	100%	72.8%

Discussion, Conclusion, and Suggestions

The study results **confirm the research hypothesis**, outlining a picture of technologically active but educationally underprepared students. The comparative analysis by gender reveals **qualitative differences** in attitudes and self-assessment that have direct pedagogical significance.

3.1. Discrepancy between confidence and awareness

The most crucial finding is the difference between self-assessment and critical awareness regarding media:

Confidence in boys: 71% of boys report a high self-assessment of their ability to distinguish fake news. This confidence contrasts with the fact that only **43%** of them check sources. This divergence can be explained by cognitive biases, corresponding to the **Dunning-Kruger Effect**, where individuals with low competence tend to overestimate their own skills (Dunning & Kruger, 1999).

Critical awareness in girls: Girls are significantly more aware of the media's influence (**81.8%** versus 50% for boys), which makes them more vigilant. This awareness leads to a higher propensity for verification (54.5%) and a lower self-assessment (45.5%), suggesting a more **realistic evaluation of their own limits**.

3.2. Digital divide in interaction with AI

The integration of AI into the educational environment is already a reality, with boys being **early adopters** of these technologies.

More intense use and confidence: 86% of boys use AI regularly and **71%** believe they understand its functioning, compared to 63.6% usage and 45.5% understanding among girls.

Universal acceptance: The complete support (**100%**) from boys for AI as a study aid, compared to some reservation (**27.2% neutral/against**) among girls, underscores the necessity for **targeted training** that presents AI as a neutral tool with both potential and risks.

3.3. Deficiency in school preparation

Both groups perceive a serious deficiency in **systematic preparation** provided by the school.

- **Critique of the educational environment:** Only **7%** of boys believe that school helps them think critically, with girls giving a higher, though still low, positive rating (**36.4%**).
- **Lack of AI training:** The most alarming result is the **zero preparation** concerning the safe use of AI among girls and the extremely insufficient preparation among boys (29%). This gap directly exposes students to risks from **academically incorrect use of generative tools** and disinformation.
- **Desire for change:** Despite the critique, the strong desire from both boys (**86%**) and girls (**63.6%**) for more lessons on media literacy and AI is a strong indicator of the **felt need** for updating curricula.

4. Overall conclusion of the study

The present study outlines the profile of technologically active but educationally underprepared students.

- **Key similarities:** Both boys and girls are in contact with digital technologies and AI, recognize the significance of these topics, and express a desire for more training in media literacy, AI, and critical thinking.
- **Key differences:** The difference lies in the **quality of interaction**—while boys are more confident and practical users of AI, girls demonstrate greater awareness of media influence and are more critical of the quality of school preparation.

These findings create a strong argument for the need for **urgent pedagogical interventions** and the development of training modules that simultaneously work to **increase skills and calibrate students' self-assessment**.

5. Discussion of results and pedagogical recommendations

The empirical results from the survey confirm the need for **targeted pedagogical intervention** at the lower secondary stage. The discrepancy between self-assessment and actual skills, as well as the low readiness for working with AI, necessitates the formulation of the following pedagogical implications and concrete recommendations for updating educational practice and preparing students for critical thinking in the age of AI.

5.1. Development of metacognitive skills and source verification

The established discrepancy between boys' high self-assessment and their low propensity for source checking (see Finding 3.1) requires the application of methods that link theory to real-world practice.

Learning through error / Didactics of disinformation: Implementation of practical tasks where students must be misled (through **fake news** or **AI-generated "hallucinations"**) and subsequently evaluate their own error. This method contributes to a more realistic assessment of their own competencies.

Systematic verification checklist: Development and implementation of unified protocols (steps) for **information verification** (e.g., reverse image search, domain checking, tracing the primary source) that should become an automated behavior.

5.2. Integration of critical algorithmic literacy for AI (AI Literacy)

The **zero preparation** for the safe use of AI and the girls' reservation toward the technology demand urgent and targeted educational intervention.

AI ethics and limitations module: Introduction of a mandatory module covering:

- **"Hallucinations"** in Generative AI and the necessity of factual verification.
- **Copyright and plagiarism** when using AI for academic purposes.
- **Bias in algorithms** and how this affects the fairness and objectivity of the generated information.
- **Developing Productivity with AI (Prompt Engineering):** Training students not just to use, but to **critically manage AI**, by formulating clear and specific tasks **(prompts)** in order to obtain more accurate and useful results.

5.3. Structural and pedagogical changes in the learning environment

The students' critical assessment of the school (only 7% of boys believe that critical thinking is developed) necessitates structural changes.

Cross-disciplinary approach: Media literacy and critical thinking should not be taught in isolation, but should be **integrated into every subject**—from the analysis of historical sources to the critical reading of scientific articles in biology and mathematics.

Teacher training: Development of **qualification programs** for teachers of all specialties (not only Informatics) so that they can identify and teach a critical attitude toward digital information and AI.

Change in pedagogical focus: Shifting from teaching based on **information reproduction** to **Problem-based learning (PBL)** and **debate**, which directly stimulates critical thinking.

Conclusion

This article presents a theoretical synthesis of media and algorithmic literacy in the context of critical pedagogy and media ecology, followed by an empirical study aimed at establishing differences in the self-assessment of literacy and the ability to recognize deepfake content between boys and girls in the lower secondary school stage.

The analysis of the collected data provided the following main findings, addressing the hypotheses posed:

- It was established that boys demonstrated a statistically significantly higher self-assessment of their media literacy.
- No statistically significant difference was found in the actual ability to recognize deepfake content between genders.

A key finding of this work is the discovery of a substantial gap (confidence-competence gap) between students' high self-assessment and their low propensity for critical verification of complex digital phenomena. This gap is a fundamental problem for the effectiveness of media literacy education.

Based on these results, the present work makes two key contributions to pedagogical science and educational practice.

Firstly, the contribution to theory concerns critical algorithmic literacy. The article expands the traditional framework of media literacy (access, analysis, evaluation, creation) with a critical dimension that is specific to the AI era. This approach integrates the principles of Freire's critical pedagogy with an analysis of power relations and biases within algorithmic systems.

Secondly, the contribution of the work is to practice (Addressing the Confidence-Competence Gap). By empirically establishing the discrepancy between confidence and skill, the work substantiates the urgent need for a transition to pedagogical methods such as learning through error analysis (Didactics of Disinformation) and systematic verification. These methods are directly aimed at correcting unrealistic self-assessment and building sustainable critical behavior.

In conclusion, preparing students for life in the age of AI requires not merely the acquisition of new tools, but a fundamental rethinking of the pedagogical process. The framework we propose for the integration of critical algorithmic literacy across all subjects represents a roadmap for educational policy that aims to place critical thinking and civic responsibility at the core of lower secondary school education.

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Authors' Declarations

Ethics Statement: We declare that this study fully complies with the ethical guidelines set forth in the "Higher Education Institutions Scientific Research and Publication Ethics Directive." We confirm that no actions against scientific research and publication ethics have been undertaken. Furthermore, we confirm that all authors have contributed to the study, and we take full responsibility for any potential ethical violations.

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Institutional Review Board Statement: Since this research is based on an anonymous survey and is conducted within the standard pedagogical practice of the involved educational institution, and the data gathered does not involve sensitive personal or health information, the study was deemed exempt from formal Institutional Review Board (IRB) approval. All participants (students) were informed about the study's aims and anonymity was ensured.

Data Availability Statement: The data presented in this study is available exclusively within the context of the current article for the purpose of scientific reporting. The raw data is not publicly available due to the requirement for maintaining the anonymity and confidentiality of the student participants. Researchers interested in access to the aggregated data may contact the corresponding author with a formal request, which will be considered in compliance with institutional and ethical regulations.

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Creative Science Experiments as a Pathway to Engagement: A Case Study from a Rural Greek Secondary School

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Abstract

This paper presents a case study of the "10th Creative Science Experiments Contest," implemented for the first time in the region of Imathia, Greece, at Gymnasio Plateos, a rural lower-secondary school serving a diverse student population facing significant socio-economic barriers. The contest aimed to enhance students' engagement with science through gamified, inquiry-based, and hands-on experimentation using everyday materials. This pedagogical approach was selected to address persistent challenges observed in the school context, including low science motivation, high grade-level dropout rates, and limited aspirations for academic progression, issues particularly pronounced among girls, Roma students, and students from economically vulnerable agricultural households. Organised in collaboration with the 1st Model Lyceum of Thessaloniki "Manolis Andronikos" and under the coordination of a central scientific committee, the contest invited students to solve open-ended scientific problems embedded within an adapted narrative. Working in small teams, participants were encouraged to design and test solutions through experimentation, applying physics, chemistry, and biology concepts in practical, playful ways. The theoretical framework guiding the initiative combined gamification principles with problem-based learning (PBL), aiming to cultivate creativity, scientific reasoning, collaboration, and positive attitudes toward science. A total of nine teams from three schools participated, including 28 students, 18 girls and 3 Roma students. Notably, one Roma student advanced to the final round, and all demonstrated improved performance and successful grade promotion following the event. Students showed higher achievement in chemistry tasks, followed by physics, while biology posed greater challenges. Qualitative reflections collected after the contest revealed strong enthusiasm for collaboration, experimentation, and the novelty of the experience, with many students expressing a desire to participate again. The findings suggest that gamified, low-cost, and contextually relevant experimentation can effectively support science learning and engagement in rural and disadvantaged school contexts. The contest functioned not only as an academic event but also as an inclusive learning intervention that strengthened students' sense of belonging, scientific confidence, and motivation. This case study provides evidence that structured, playful, and problem-centered science experiences can help narrow equity gaps in STEM education and promote meaningful participation among students traditionally underrepresented in science.

Keywords: Gamification; Problem-Based Learning (PBL); Inclusive Science Education.

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Introduction

Interest in science subjects among secondary school students, especially girls and socio-economically marginalized groups, is often low, particularly in rural contexts where opportunities and aspirations for higher STEM education remain limited (Stoet & Geary, 2018; UNESCO, 2024). Such disengagement contributes to dropout rates and underrepresentation in scientific pathways (Stoet & Geary, 2018). The region of Imathia in Greece, characterized by rural communities with high percentages of Roma, Albanian, and Muslim-Greek students, reflects this challenge: many students face structural barriers to sustained engagement with science.

To address these issues, gamification has emerged in educational research as a strategy to enhance motivation and engagement by applying game design elements such as challenges, feedback, badges, and rewards, in non-game settings (Kim & Castelli, 2021). Meta-analyses show that gamified learning can improve student motivation, collaboration, critical thinking, and self-confidence, though outcomes vary depending on design and context (Wouters et al., 2013; Ramirez Ruiz et al., 2024). The integration of narrative and cooperative elements can further leverage motivation and peer interaction (Sailer & Homner, 2020; Ramirez Ruiz et al., 2024).

Problem-based learning (PBL) complements gamification by centering learning around open-ended, real-world problems that students must investigate and solve (Hmelo-Silver, 2004). PBL has been shown to foster deeper conceptual understanding, critical thinking, and self-directed learning in science education (Hmelo-Silver, 2004). In contexts where physical resources are limited, students engaging in inquiry using everyday materials can still achieve meaningful scientific learning and ownership of knowledge.

By combining gamification and PBL in a contest format, inviting students to interpret a relatable story, experiment with accessible materials, and collaboratively solve scientific challenges, the approach aims to make science learning both inclusive and empowering. Specifically, the "10th Creative Science Experiments Contest" employed simple, contextually grounded tasks within a competitive but supportive framework, activating students traditionally underrepresented in STEM.

This study explores how such a gamified PBL competition influenced student engagement, performance, and attitudes in science among a diverse rural student population. It examines whether the intervention can foster not only motivation and collaboration but also equity in STEM participation, particularly for girls and Roma students.

Literature Review

Research in science education increasingly emphasises the importance of active, student-centred pedagogies that promote engagement, inquiry, and conceptual understanding. One prominent approach is gamification, defined as the integration of game elements (e.g., challenge, narrative, competition) into non-game contexts to increase motivation (Deterding et al., 2011). Gamification has been shown to enhance students' behavioural and emotional engagement, particularly when combined with meaningful learning tasks rather than superficial reward systems. In science education specifically, gamified activities can support curiosity, persistence, and deeper exploration of scientific concepts (Kapp, 2012). However, researchers caution that the effectiveness of gamification depends heavily on its design, poorly designed systems may increase anxiety or disengage students who feel less competent (Seaborn & Fels, 2015). This underscores the need for carefully structured, low-stakes gamified learning environments such as collaborative competitions or playful experiments using everyday materials.

Complementary to gamification, problem-based learning (PBL) and inquiry-based science education (IBSE) form the theoretical backbone of contemporary constructivist science-learning models. PBL positions students as active problem-solvers working in groups to address open-ended questions, thereby fostering higher-order thinking and transferable skills (Barrows, 1996; Hmelo-Silver, 2004). Meta-analyses indicate that inquiry-based and problem-focused pedagogies lead to improved conceptual understanding, engagement, and scientific reasoning, particularly when students receive structured guidance (Minner et al., 2010; Lazonder & Harmsen, 2016). Hands-on experimentation with everyday

materials has also been found to lower barriers to participation by reducing fear of failure and supporting intuitive connections between scientific ideas and daily life. Despite these benefits, the literature notes that PBL and IBSE may be less accessible in resource-constrained rural schools, where large class sizes, limited laboratory access, and lower teacher confidence can hinder implementation. As such, low-cost creative experiment projects and competitions may represent a scalable model for such settings.

A major theme across recent scholarship is the persistent issue of equity in STEM education. Students from socio-economically disadvantaged backgrounds, minority ethnic groups, and rural regions consistently demonstrate lower participation, achievement, and science identity development (Mujtaba & Reiss, 2012; OECD, 2018). Longitudinal studies (Archer et al., 2013) show that structural inequalities, including limited role models, restricted access to enrichment activities, and lower familial expectations, shape students' science aspirations from an early age. Research on Roma students in Europe highlights significant barriers such as discrimination, early school leaving, and limited educational support, all of which negatively influence progression in STEM pathways (European Union Agency for Fundamental Rights [FRA], 2014). These findings highlight the urgent need for inclusive and culturally responsive science-education initiatives that foster belonging and competency among students traditionally marginalised in STEM learning environments.

Gender disparities form another critical dimension of STEM participation. Global monitoring reports from UNESCO (2017) show that girls often exhibit lower self-confidence in science despite performing as well as or better than boys academically. Social norms, stereotypes, and limited access to hands-on science experiences are key factors contributing to their diminished interest in STEM careers (Wang & Degol, 2017). Interventions that promote collaborative learning, emphasise real-world relevance, and reduce competitive pressure have been shown to particularly benefit girls' engagement in science (Koch et al., 2014). Therefore, inclusive competition formats that emphasise cooperation, creativity, and problem-solving rather than high-stakes rivalry may help address gender gaps in science motivation.

While prior research demonstrates the value of gamification, PBL, and inclusive hands-on science learning, few studies explore their combined use in rural multicultural school contexts, especially those with high proportions of Roma, immigrant, or socio-economically disadvantaged students. Even fewer studies examine how creative science-experiment competitions can serve as both motivational and pedagogical tools. There is limited empirical evidence on how such competitions influence science identity, participation, or academic confidence among marginalised learners. This gap highlights the need for research investigating how playful, inquiry-driven, low-cost science competitions can foster engagement and support equity in diverse rural secondary schools. The present study responds to these gaps by examining a gamified, problem-based science-experiment contest implemented in a rural Greek school with multiple groups traditionally underrepresented in STEM, offering insights into its pedagogical potential and equity implications.

Context & School Profile

Gymnasio Plateos is located in a rural area of Central Macedonia, Greece, where schools face structural and socio-economic challenges that can affect student engagement and academic outcomes (OECD, 2019; OECD, 2023). Rural schools often contend with limited educational resources, reduced extracurricular opportunities, and lower participation rates in advanced subjects, including science, technology, engineering, and mathematics (STEM) (OECD, 2019).

The student population at Gymnasio Plateos is culturally and linguistically diverse. Approximately 36% of students are Roma, 14% are from Albanian backgrounds, and 8% are Muslim Greeks. Such diversity aligns with broader European patterns in which Roma and other minority students encounter systemic barriers to education, including poverty, discrimination, and limited access to quality schooling (ERRC, 2002; Parthenis, 2023; Papachristou, 2023). Studies in Greece have highlighted that Roma students often experience educational marginalization, which contributes to high absenteeism and dropout rates (Georgiadis & Zisimos, 2012; Papachristou, 2023). Similarly, immigrant and minority students may face challenges related to language, cultural integration, and limited parental educational support, which can negatively influence academic performance (UNICEF Greece, 2021; Pijaca Plavšić, 2024).

Student motivation in science is generally lower in such rural and socio-economically disadvantaged contexts (OECD, 2023). Research suggests that children from marginalized backgrounds often have limited exposure to STEM role models and extracurricular STEM opportunities, which reduces the likelihood of developing interest or pursuing careers in science-related fields (UNICEF Greece, 2021). Gender disparities also intersect with these challenges: girls from minority and rural populations are less likely to express interest in physical sciences, consistent with European patterns of gendered differences in STEM engagement (Archer et al., 2013).

Gymnasio Plateos has historically faced challenges with absenteeism and grade retention, particularly in the first grade of junior High school. High dropout rates among marginalized groups, including Roma students, are well-documented in Greece and across Europe, with rural regions being particularly affected (Papachristou, 2023; Parthenis, 2023). These structural and cultural factors create a pressing need for interventions that enhance student engagement, provide equitable access to STEM learning, and foster motivation.

Despite these challenges, the school has a history of participating in initiatives aimed at promoting STEAM education and inclusivity. Partnerships with external institutions, such as universities and local educational organizations, have been leveraged to create opportunities for experiential learning and practical engagement with science, aiming to bridge gaps in access and achievement (UNICEF Greece, 2021; Pijaca Plavšić, 2024). Within this context, the "Creative Science Experiments Contest" was implemented as an innovative intervention designed to enhance engagement, support collaborative learning, and provide all students, especially those from marginalized backgrounds, with a meaningful and inclusive experience in scientific inquiry.

Method

Research Design

This study adopted a mixed-methods embedded case-study design to investigate how a gamified, problem-based science competition influenced student engagement, performance, and attitudes. Case studies are well-suited for investigating educational interventions situated within real-world contexts, enabling in-depth understanding of complex processes and interactions (Yin, 2003). An embedded design was chosen because the study examined both the overall event and its constituent subunits (student teams), reflecting the structure recommended by Scholz and Tietje (2002). To strengthen validity, the study used methodological triangulation, combining observations, performance assessments, and student reflections, consistent with mixed-methods guidelines (Creswell & Plano Clark, 2018).

Participants and Sampling

Participants were 28 lower-secondary students (18 girls, 10 boys) from three schools in the region of Central Macedonia, Greece. Sampling reflected the principles of maximum-variation sampling, which seeks to include participants with differing characteristics to reveal shared patterns across diversity (Patton, 2002). Gymnasio Plateos, the primary site, serves a socioeconomically and culturally diverse population, including Roma, Albanian-background, and Muslim-Greek students, making it particularly relevant for equity-focused science-education research. The inclusion of students from marginalized groups aligns with prior work emphasizing the need to explore engagement and identity formation in STEM among underrepresented populations (Archer et al., 2013).

Intervention: The Science-Experiment Competition

The three-hour "Creative Science Experiments Contest" functioned as the pedagogical intervention. The competition was structured around problem-based learning (PBL), in which students were provided with a narrative scenario inspired by everyday life and were asked to design and conduct experiments using simple, low-cost materials. PBL has been shown to foster conceptual understanding, inquiry skills, and transfer of knowledge, especially in science education (Strobel & van Barneveld, 2009). The contest also incorporated gamification elements—time constraints, challenge-based tasks, and collaborative team competition—following research indicating that such elements increase student motivation, persistence, and engagement (Kapp, 2012). Working in groups allowed students to engage in

collaborative problem solving, an approach that enhances communication and scientific reasoning in secondary science contexts (Gillies & Boyle, 2010).

Data Collection

To capture the multidimensional nature of students' experiences and learning, data were collected from four sources:

Performance Assessments: Teams completed challenges in chemistry, physics, and biology. Their responses were evaluated using an analytic rubric constructed to assess conceptual accuracy, creativity, and experimental design. Rubric-based evaluation is widely recognized for increasing reliability in performance assessments (Jonsson & Svingby, 2007).

Student Written Reflections: Immediately after the contest, students completed short reflective questionnaires about their experiences, perceived challenges, enjoyment, and collaboration. Reflection prompts were adapted from existing tools used in inquiry-based science studies (Ketpichainarong, Panijpan, & Ruenwongsa, 2010).

Researcher Observations: Two trained observers documented team interactions, problem-solving processes, and behaviors during experimentation. Observational field notes are an established data source in case-study and PBL research because they reveal authentic student strategies during task engagement (Stake, 2005).

Follow-up Academic Data: With consent, school records were examined to track whether participants demonstrated changes in science performance or grade progression after the event. Using existing academic data is a common method for assessing short-term educational impact (Creswell, 2014).

Data Analysis

Performance scores were analyzed descriptively (means, distributions, domain comparisons). Differences across groups (e.g., gender, minority students) were explored through comparative statistics to identify patterns. Descriptive approaches are standard in small-sample educational case studies where inferential tests may be inappropriate (Mertler & Charles, 2011).

Codes were generated inductively and then grouped into broader themes such as "collaboration," "creative engagement," "challenge," and "motivation." Triangulation between reflections and observations helped validate themes across data sources.

Integration occurred at the interpretation stage using a convergent embedded strategy, comparing quantitative performance patterns with qualitative themes to produce a holistic understanding of student engagement (Creswell & Plano Clark, 2018).

Ethical Considerations

The study adhered to established ethical guidelines for research with minors. Parental consent and student assent were obtained. Participation was voluntary, and students could withdraw at any time. Data were anonymized through coded identifiers, and all records were stored securely. These procedures align with educational research ethics outlined by the American Educational Research Association (AERA, 2011). A post-event debriefing ensured that students were informed about the study's purpose and had an opportunity to reflect on their experiences.

Results

Student Participation and Demographics

A total of 28 students from three schools participated in the contest, including 18 girls and 10 boys, distributed across nine teams of 3–4 students each. Among these participants, three were Roma students, and one reached the final phase of the competition. Despite the small sample size, the diversity of the participants reflects the broader demographic composition of rural schools in Central Macedonia and provides insight into the engagement of underrepresented groups in STEM (ERRC, 2002.; Parthenis, 2023).

Engagement and Time on Task

Observation and student reflection data indicate high levels of engagement throughout the three-hour competition. Most teams actively pursued experimental solutions for the given scientific challenges, demonstrating sustained focus and persistence. Engagement during inquiry-based, problem-solving activities is a key predictor of conceptual understanding and learning outcomes in science education (Prince, 2004; Hmelo-Silver, 2004). Students spent most of the allotted time collaboratively discussing hypotheses, designing experiments, and analyzing results.

Performance Across Subjects

Student performance varied across the three scientific domains:

Chemistry: Students exhibited the highest overall performance, correctly identifying chemical phenomena, and drawing conclusions consistent with scientific principles.

Physics: Performance was moderate, with most teams able to apply basic principles to experimental setups, though some struggled with conceptual reasoning and quantitative measurements.

Biology: Students demonstrated the lowest performance in biology-related tasks, often producing incomplete or partially accurate explanations.

These patterns align with prior research showing that performance in practical, hands-on science tasks is influenced by students' prior exposure and confidence in each discipline (Archer et al., 2013; OECD, 2019).

Collaboration and Problem-Solving

Field notes and student reflections highlighted strong collaborative behavior. Teams effectively delegated responsibilities, shared ideas, and solved problems collectively. Several students noted that working in groups encouraged creative thinking and allowed them to approach experimental challenges from multiple perspectives. This aligns with literature indicating that collaborative inquiry promotes scientific reasoning, critical thinking, and the co-construction of knowledge in secondary science education (Gillies & Boyle, 2010).

Student Reflections

Analysis of written reflections revealed four prominent themes:

Collaboration: Students valued working together and learning from peers.

Creativity and Innovation: Participants appreciated opportunities to design experiments using everyday materials.

Challenge and Engagement: Students described tasks as stimulating, requiring strategic thinking and careful planning.

Positive Learning Environment: Many participants highlighted the inclusive and supportive atmosphere of the contest, which fostered motivation and confidence.

These findings corroborate previous research showing that gamified, problem-based learning experiences increase engagement and intrinsic motivation, particularly among students who may be underrepresented in STEM (Kapp, 2012; Hmelo-Silver, 2004).

Outcomes for Underrepresented Students

Notably, all three Roma students demonstrated improvement in their scientific reasoning and experiment completion. One student advanced to the final phase of the competition. Furthermore, all three were promoted to the next grade, indicating that participation in the contest may have positively influenced both academic achievement and confidence. These results are consistent with studies showing that structured, inclusive science interventions can enhance STEM outcomes for marginalized students (ERRC, 2002; Parthenis, 2023).

Gender Considerations

While the small sample limits statistical generalization, female participants expressed high engagement and enjoyment, particularly in collaborative and creative tasks. However, performance data suggest that gender disparities persisted in certain domains, reflecting broader trends in physical science participation among girls in rural contexts (Archer et al., 2013). These findings emphasize the importance of inclusive, hands-on interventions that address both motivation and opportunity gaps in STEM education.

Discussion

The findings of this case study demonstrate that a structured, inquiry-based, and gamified science contest can serve as an effective pedagogical intervention in rural, socio-economically diverse school settings. The high levels of student engagement observed throughout the event indicate that hands-on, problem-based formats resonate strongly with learners who may otherwise exhibit low motivation in science, particularly in disadvantaged contexts (Prince, 2004; Hmelo-Silver, 2004). The contest's design, prioritizing creativity, collaboration, and everyday materials, appears to have mitigated some of the resource limitations commonly found in rural schools (OECD, 2019) and provided an accessible entry point into authentic scientific inquiry.

A notable outcome concerns the participation and performance of students from marginalized groups, particularly Roma students. Although representing a small portion of the participants, all three Roma students demonstrated measurable academic gains, with one advancing to the final round and all three progressing to the next grade level. These results echo previous research showing that inclusive, participatory approaches can partially counterbalance entrenched structural barriers in Roma education (ERRC, 2002; Parthenis, 2023). The increased engagement and improvement observed among these learners suggest that experiential, contextually meaningful science learning can play a role in reducing disparities in STEM participation.

Gender-related findings align with existing literature on girls' STEM participation. Although girls exhibited strong engagement and teamwork, consistent with earlier studies highlighting their affinity for collaborative scientific environments (Archer et al., 2013), subject performance patterns still reflected broader gendered trends, particularly in physics. These disparities suggest that engagement alone may not fully counteract the underlying socio-cultural factors influencing science identity formation. Nonetheless, the positive attitudes expressed by female participants indicate that such interventions may contribute to building confidence and sustained interest, especially when embedded within supportive, mixed-gender collaborative settings.

The differential performance across disciplines, higher success in chemistry, moderate in physics, and lowest in biology, suggests that students' prior exposure, familiarity, or instructional emphasis may influence contest outcomes. These patterns are in line with international findings showing that student achievement in science varies by domain, often reflecting curriculum coverage, teacher specialization, and local educational priorities (OECD, 2023). Such insights highlight the importance of targeted support for less-confident domains, especially biology, where conceptual reasoning was most challenging.

Another central finding concerns the value of collaboration. Students consistently emphasized teamwork, shared decision-making, and collective problem-solving as key contributors to their experience. This supports extensive evidence that cooperative learning enhances scientific reasoning, engagement, and learning outcomes (Gillies & Boyle, 2010). The contest environment encouraged distributed responsibility, peer support, and democratic participation, factors that have been shown to particularly benefit students from culturally diverse or educationally marginalized backgrounds.

Overall, the results affirm the potential of experiential, gamified, and inclusive science activities to foster engagement, enhance learning, and narrow participation gaps in STEM within rural contexts. While this case study is limited by its small sample size and context-specific nature, its outcomes underscore the need for further research and larger-scale implementation. Future initiatives should investigate long-term effects on science identity, performance, and educational trajectories, particularly for minority and rural students who are typically underrepresented in STEM pathways.

Conclusion

The implementation of the Creative Science Experiments Contest at Gymnasio Plateos illustrates how thoughtfully designed, low-cost, and collaborative science activities can offer meaningful educational value in rural and socio-economically diverse school settings. Beyond the immediate learning outcomes, the contest functioned as a catalyst for fostering a more positive relationship with science, providing students with opportunities to explore, question, and collaborate in ways not always accessible in traditional classroom formats.

The broader significance of this initiative lies in its capacity to create educational spaces that prioritize inclusion, agency, and engagement. By integrating experimentation with everyday materials and placing students in active problem-solving roles, the contest supported the development of scientific reasoning and confidence, while also strengthening peer interactions and a sense of belonging. Such environments are particularly valuable in schools where structural inequities and limited resources often constrain students' access to enriching STEM experiences.

The case study further underscores the potential of targeted, experiential interventions to complement formal science instruction and expand students' understanding of what it means to engage in scientific inquiry. Although the scope of the project was limited, the positive reception and observable shifts in engagement suggest that similar initiatives could be scaled or integrated more systematically across schools in comparable contexts.

Finally, the contest highlights the importance of designing science education that is both contextually grounded and responsive to local needs. As educational systems continue to address disparities in STEM participation, especially for students from marginalized or rural backgrounds, models such as this provide a promising direction for fostering curiosity, resilience, and a sustained interest in scientific learning.

Suggestions

Based on the outcomes of this case study, several practical and research-oriented recommendations emerge. First, schools in rural or socio-economically diverse contexts may benefit from integrating low-cost, hands-on science challenges into the regular curriculum. The contest model demonstrates that structured inquiry with everyday materials can promote engagement and scientific reasoning without requiring substantial resources. Embedding similar activities across grade levels could help sustain students' interest in science throughout their school experience.

Second, the positive engagement observed among students from marginalized backgrounds suggests that experiential, collaborative formats should be prioritized in efforts to promote educational equity. Schools and regional authorities may consider adopting inclusive science events as part of broader strategies aimed at supporting Roma, immigrant, and first-generation students. Partnerships with universities or scientific organizations can further enhance such initiatives by providing external support, mentoring, and visibility.

Third, the gender patterns observed in participation and reflections indicate a need for interventions specifically designed to strengthen girls' confidence and sense of belonging in physical sciences. Programs that emphasize teamwork, real-world relevance, and creative problem-solving may be especially effective and should be developed and evaluated with gender responsiveness in mind.

From a research perspective, future studies should investigate the longer-term impact of such contests on students' academic performance, science identity, and STEM aspirations. Longitudinal designs would help determine whether gains in engagement translate into sustained interest or improved outcomes. Comparative studies across schools with different socio-economic and cultural profiles would also contribute valuable insights into the scalability and adaptability of the contest model.

Finally, further research should explore how culturally responsive, gamified, and problem-based approaches to science learning can be systematically integrated into national curricula. Such work would help bridge the gap between innovative practices and everyday teaching, contributing to a more inclusive and motivating STEM education landscape.

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Course Content Draft for the Guitar Education and Accompaniment Course within the Framework of an Eclectic Approach

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Abstract

This study aims to design course content that can be applied within the scope of Guitar Education and Accompaniment I-II courses, which were included in the Music Education Bachelor's Program by the Higher Education Council (YÖK) in 2018, within the framework of an eclectic approach. In the Music Teacher Education Undergraduate Program implemented by the Council of Higher Education (YÖK) prior to 2018, it is observed that, in addition to individual instrument training, the aim was to provide prospective music teachers with basic-level instruction on instruments such as the guitar, bağlama, and recorder under the course titled 'School Instruments'. However, evaluations conducted as a result of the implementation process have revealed the need to improve the content of this course. As a result of the necessary adjustments, the School Instruments course was removed from the Music Teaching Bachelor's Program published in 2018 and replaced with the courses Bağlama I-II and Guitar Education and Accompaniment I-II, each planned for two semesters. Considering the advantages of the guitar—such as its suitability for accompaniment, ease of portability, and greater accessibility compared to many other instruments—this new revision is regarded as an important step in the music teacher education process. In addition to being a solo instrument, the guitar is also very popular as an accompanying instrument. At this point, it can be considered one of the instruments that play a major role in and reinforce the first steps taken in music, especially during childhood and adolescence. In the process of instrumental education, the integration of theoretical and practical components as a unified whole is effective in achieving an ideal learning outcome. At this point, it is considered important for music teachers who will work at the primary and secondary education levels to possess basic and intermediate-level guitar playing skills; this is regarded as significant both for managing the educational process accurately and efficiently in their professional careers, and for developing their ability to guide their

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students. The student's conscious awareness of what they are doing on their instrument, how they are doing it, and why they are doing it is achieved through the repetition and reinforcement of theoretical knowledge, the transfer of knowledge between different areas, and the application of knowledge in different situations, moments, and fields. The conscious use of knowledge during practice, through an approach that avoids rote memorization, will lead to instrumental mastery—regardless of the student's playing level. Based on this, this study, conducted using qualitative research methods, has created a comprehensive content aimed at developing accompaniment skills by transferring information from basic guitar playing techniques and Western music theory and harmony course content to the Guitar Education and Accompaniment I-II courses. Particular attention was paid to ensuring that knowledge and practice progressed simultaneously rather than sequentially; efforts were made to explore how the acquired knowledge could be applied across different moments and domains in a step-by-step manner. These efforts also incorporated practices aimed at learning how to teach. The content was developed within a tonal framework, and for each selected tonality, it was structured around scales, melodies, classical pieces, school music songs, and popular song patterns. Simultaneously, theoretical components such as chord progressions in the relevant tonality, cadence exercises, form and harmonic analysis, as well as deriving chords and creating accompaniments based on these analyses, were also included.

Keywords: Music Teacher, Guitar Education, Guitar Accompaniment, Guitar Education and Accompaniment

Introduction

The music teaching education process is structured with courses that enable teacher candidates to apply the professional knowledge they acquire during the process and develop their instrumental skills. One of the common denominators of music teaching programs, which have changed over time, is that prospective music teachers are introduced to a variety of instruments during their education and acquire at least a basic level of proficiency in playing instruments other than their own. The 'school instruments' course included in the YÖK Music Teaching Program implemented until 2018, which featured different instruments in each semester, can be cited as an example of this. However, there have been criticisms regarding the insufficient duration of the school instruments course and the way the course is conducted. Ergül and Yöndem (2024) stated that the division of the School Instruments course in previous programs into sections such as "baglama, recorder, mandolin, guitar, and Orff instruments" caused some students to start their careers without any formal connection to the guitar (p. 2475). In their research with music education faculty members and students, Gökalp and Şahin (2013) concluded that allocating one semester each for guitar and bağlama was insufficient, that adjustments were needed at the grade levels where the School Instruments course was taught, and that the variety of school instruments should be expanded and their duration extended (p. 101). As a result of the necessary adjustments, the 2018 program replaced the school instruments course with Bağlama I-II and Guitar Education and Accompaniment I-II courses. This development is considered positive because the duration of instrument education has been extended to two semesters compared to the school instruments course, and its scope has been broadened.

The professional music education process is extremely important for music teacher candidates to acquire accompaniment skills. Given the importance of singing a school song with accompaniment, there are very few songs written with accompaniment in the school music repertoire. In particular, almost all of the songs in music textbooks are written in one voice and without accompaniment. The accompaniment of songs to be taught in music class depends entirely on the music teacher's knowledge and skills in this area. Therefore, in order for music teacher candidates to be competent in the field of accompaniment when they start their careers, they need to develop their accompaniment skills during their education process (Piji, 2007, p.114). Tokatlı (2024) emphasized the effect of accompaniment on the development of students' musical tastes and musical skills in music education and on the increase in music teachers' classroom control (p. 6). The guitar is an ideal instrument due to its structure, popularity, portability, and relative ease of acquisition. Ayyıldız and Erim (2020) stated that in song teaching, the melody is taught through note reading and/or ear training, and at this stage, the guitar can support teaching by playing the melody in a single voice. However, they added that using the guitar's accompaniment feature to play the melody with guitar accompaniment would add a different dimension to song teaching. From this perspective, he stated that adapting school songs to the guitar in a polyphonic manner could ensure more effective song teaching and more functional use of the guitar in lessons (87). It is considered important for music teachers who will work in primary and secondary education to have basic and intermediate guitar playing skills, not only to manage the education process correctly and efficiently but also to guide their students. Küçüköncü (2006) emphasized this importance, stating, "A music teacher should be able to use their artistic instrument to accompany their students and educate them by developing their musical personalities; they should also be able to use the school instrument as both an educational tool and a teaching tool. The music teacher must know how to use school instruments at a level where they can play and teach them in class and in extracurricular activities" (quoted in Gökalp and Şahin, 2013, p. 118). Studies have also shown that this situation is reflected in the educational environment and that the guitar is preferred by both teachers and students (Ayyıldız and Erim; Gökalp and Şahin; Uluocak; Uluocak and Tufan; Yungul).

Problem Statement

When examining the course information packages of universities for guitar education and accompaniment I course resources, it was observed that, in addition to the course notes of the relevant teaching staff, classical guitar methods and repertoire books were mostly included, while harmony-based resources for accompaniment practice were not found. A review of the literature similarly points to the

lack of a resource that directly targets these gains. A review of the literature again failed to identify a resource targeting these outcomes. In his research, Yungul (2008) interviewed guitar course instructors and concluded that very little space was given to accompanied school songs in resource books for guitar education (p. 45). In his research, Özkasnaklı (2023) interviewed seven field experts for guitar education and accompaniment lessons and obtained similar data. The experts were asked about their opinions on the teaching materials they used in guitar education and accompaniment 1 lessons, and five experts stated that they compiled their own resources, two experts used the classical guitar method, and one expert stated that they could not find harmony and accompaniment materials (p. 29).

Considering the course name and content specified in the YÖK music teaching program, it is thought that while students are taught basic guitar playing skills, they should also be taught accompaniment production/playing skills and the basic harmonic knowledge and accompaniment skills necessary for accompaniment. At this point, the necessity for the course content and the materials to be used in this direction to cover all these gains and to be of a nature that can establish a connection by providing coordination between theoretical knowledge and application areas constitutes the problem situation of the study. Based on this, this study aims to prepare a lesson content outline for the planned development of accompaniment knowledge and skills, accompanied by basic theoretical information, while also giving the guitar a place as a solo instrument in the guitar education process. The study is considered important in terms of its structure, which aims to impart accompaniment skills using theoretical, harmonic, and structural knowledge in a holistic approach, in addition to imparting guitar playing skills. Furthermore, considering that faculty members teaching classical guitar at universities are also trained within the framework of classical guitar pedagogy, it is thought that the prepared content outline could serve as a guide in directing the educational process.

Method

This research was designed using a qualitative research method. While preparing the course content, the course content of Guitar Education and Accompaniment I included in the YÖK Music Teaching Undergraduate Program was taken into consideration, and the content and resources specified in the course information packages on the websites of universities in Turkey were examined. The reviews revealed a lack of resources for the course content and, consequently, a systematic content gap. Based on the field experience, knowledge base, and pedagogical observations of researchers who are experts in guitar education and also among the authors of this paper, the following courses were added to the existing course content: Western Music Theory and Practice I-II, Harmony and Accompaniment I-II, and the theoretical information included in the course Western Music Genre and Form Knowledge, which is an elective course in the program, and to enable the practical application of this information on the guitar. After the content outline was created, the work was submitted to two independent field experts for their opinions; the necessary adjustments were made based on the experts' feedback, and the final form of the content was given.

Findings

The content of the Guitar Education and Accompaniment I course in the YÖK Music Teaching Program includes: “Structural characteristics of the guitar, its brief history, areas of use and types, basic guitar grip and different grip shapes, note and ‘Tab’ system, supported strokes with the ”p-i-m-a" fingers (Apoyando), unassisted strumming (Tirando) techniques, melody, scale or finger exercises, arpeggio technique, 2/4, 3/4, 4/4 rhythm exercises, basic chord structures in the 1st position, I-IV-V. harmonic progression patterns, accompaniment exercises for songs with rhythms that can be played in the 1st position, capo usage; accompanying children's, youth, and popular songs with the playing techniques they have learned" is stated. When the content is evaluated in general, it is seen that, as in all basic instrument education processes, it starts with information about the instrument and posture and continues with basic guitar playing techniques. This is followed by chord structures, cadences, and accompaniment exercises.

Looking at the program content, it is seen that the course has a technically focused structure and is not supported by the theoretical knowledge necessary for accompaniment. However, it is considered that music teacher candidates receiving academic-level education need to know not only how to play in practice but also how accompaniment is created and what steps to follow. These basic theoretical

concepts are covered in the Music Theory and Practice I-II courses offered in the first and second semesters of the music teaching program, the Harmony and Accompaniment I-II courses offered in the third and fourth semesters, and the Western Music Genres and Forms course offered as an elective in the program. Information on solfège, harmony, and musical forms, which are among the topics covered in the Music Theory and Aural Training course, can also be used to develop accompaniment skills. The work analyses, studies of the forms of the works, and studies related to interval and tone knowledge, intervals and chords to be carried out in this course are the knowledge and skills necessary for accompanying school songs (Piji, 2007, p.115).

The content of the Guitar Education and Accompaniment course, which takes place in the fifth and sixth semesters, was created with the idea that the systematic use of previously learned information in a theoretical manner would facilitate the recall of information, reinforces it, fills in gaps, and allows students to see how it can be used in different situations. From the outset, the priority has been to create a progression that ensures simultaneous advancement of instrumental playing skills and theoretical knowledge at every stage, while also treating knowledge and skills as formulas to develop the ability to use that knowledge.

YÖK Music Teaching Program; Western Music Theory and Practice 1 course content: Measure, rhythm, key concept, interval and tonality concept, chord formation in music; basic musical terms used in reading and writing music (aids for duration, expression marks, ornaments, terms for tempo and dynamics, etc.); major and minor scales; chords in root position; reading and writing monophonic melodies in different keys appropriate to the level. Western Music Theory and Practice 2 course content: Concepts of motif, phrase, and period in music; root and inverted chords; transposition; different rhythmic structures; reading and writing melodies in keys with at least two flats and two sharps. Harmony and Accompaniment 1 course content: Knowledge of major and minor tonality; formation and inversion of chords; four-part, major-minor chord progressions in a narrow range (plagal, authentic, perfect cadence) and creating accompaniment patterns on the piano with these progressions; harmonic analysis of melodies within a five-note range and creating accompaniment for these melodies on the piano using block chords in appropriate inversions. Harmony and Accompaniment 2 course content: Use of secondary degrees, broken extended cadence connections, march harmony, seventh and ninth chords and their use, harmonic analysis of melodies within an octave and larger intervals and creating accompaniment for these melodies on the piano; harmonic analysis of school songs and accompanying them on the piano, creating simple accompaniment for melodies suitable for the level. Western Music Genre and Form Knowledge course content: The concept and necessity of form; the basic elements of form in music, motif phrase, period, and theme; song forms (one-part, two-part, and three-part song forms, compound song forms, rondo forms); international popular music forms are specified.

The inclusion of Guitar Training and Accompaniment I-II courses in the fifth and sixth periods creates the expectation that students will have sufficient readiness in terms of basic knowledge for accompaniment. However, it is thought that transferring the knowledge learned at this point to a different learning area will impart and develop the ability and approach to use that knowledge. At the same time, it will provide an opportunity to reinforce the knowledge and correct any misconceptions. . In this way, it is thought that the systematic use of previously learned information in the ‘Guitar Education and Accompaniment’ course content will enable the information to be remembered, reinforced, gaps to be filled, and ways in which it can be used in different situations to be seen.

'Tonality' was taken as the determining factor when creating the weekly lesson content. It was designed to work on a classical guitar piece or etude written in the relevant tonality, a school song, and a popular song in three-week periods.

Following these studies, the school song, which uses the same tonality and chord structures, is practiced, starting with the melody. Practicing the monophonic melody of the relevant song is important in terms of mastering the instrument. The melody played is analyzed by transferring knowledge from Western music theory and harmony lessons, explaining which chords can be played measure by measure. Accompaniment patterns for the school song melody were suggested based on the resulting chords. The accompaniment patterns are practiced in sequence using arpeggios, block chords, and a combination of

both techniques (arpeggio-block chord). After practicing the school song melody and accompaniment patterns, the students take turns accompanying the melody.

Table 1.
First Study of the Pattern

Technical exercises (Tab)			Scale studies in the relevant key	
Classical piece				
Melody transcription	Technical analysis and playing	Form analysis	Harmonic analysis	Accompanying with block chords

The first part of the pattern includes technical exercises written as tablature, scale studies in the key being worked on, and classical piece transcription and analysis, along with block chord accompaniment practice. This is followed by the transcription, study, and form and harmonic analysis of the piece. Based on the analysis, the identification of phrases and chords and the study of chord connections are followed by block chord work using the chord progression revealed by the analysis. While working on block chord studies related to these chords and chord transitions, the aim is also to develop right-hand technique. At the end of the course, students are expected to play a technical exercise, a scale, a classical piece, and an accompaniment, as well as apply their theoretical knowledge, such as analysis, chord identification, and chord connection, in practice.

Table 2.
The Second Study of the Pattern

Chords Derived from Classical Work Analyses					Cadence Studies in the Relevant Key	
School Song						
Transcription	Technical Analysis and Playing	Form Analysis	Harmonic Analysis	Finding Alternative Chords	Identifying Chords	Creating and Playing Accompaniment for the Song

In the second study of the pattern, the school song, which uses the chord structures learned in the first study of the pattern, is first practiced as a melody. Practicing the monophonic melody of the relevant song is important in terms of instrumental mastery. The melody played is analyzed by transferring knowledge from Western music theory and harmony lessons, and work is done on which chords can be played measure by measure. Accompaniment patterns are suggested and played for the school song melody using the resulting chords. The accompaniment patterns are practiced in sequence using arpeggios, block chords, and a combination of both techniques (arpeggio-block chord). After the second period, rhythm accompaniment is added to the accompaniment patterns with the study of rhythm. After working on the melody of the school song and the accompaniment patterns, the students take turns accompanying the melody. At the end of this lesson, the student identifies the chords and their connections based on cadence knowledge and analysis. They perform theoretical applications on how to find the chords of a song, and alternative chords are also found to reinforce theoretical knowledge. Appendix 1 contains an example of the school song work process.

Table 3.
The 3rd Study of the Pattern

Exercises with Arpeggio Formulas			Harmony Applications Studies in Different Rhythmic Structures	
Popular Songs				
Melody Transcription	Technical Analysis and Playing	Form Analysis	Harmonic Analysis	Accompanying with Block Chords

In the third exercise of the pattern, there are exercises with arpeggio formulas, works that include the learned chord progressions in the key being studied but contain rhythmic differences, and popular songs. The reason for using arpeggio formulas and works with different rhythmic structures is to enable students to have the foundation to generate alternative ideas and new ideas when accompanying.

The school song, which uses the same chord structures and key, is practiced primarily for its melody. Practicing the monophonic melody of the relevant song is important in terms of instrumental mastery. The melody played is analyzed by transferring knowledge from Western music theory and harmony lessons, explaining which chords can be played measure by measure. Accompaniment models for the school song's melody are suggested based on the resulting chords and their sequence. The accompaniment models are practiced in sequence: arpeggio, block chord, and a combination of both techniques (arpeggio-block chord). After working on the school song's melody and accompaniment models, students take turns accompanying the melody.

This 14-week lesson plan outline, prepared under this general framework;

Week 1 content: Structure of the classical guitar, guitar maintenance, finger names, sitting-standing-holding information, explanation and application of tirando – apoyando techniques, position information, tablature writing, and technical exercise practice.

Week 2 content: Tuning system and process, sounds and intervals on the guitar, sounds on the fretboard in horizontal and vertical progression, diatonic practice in the 1st position, practice on the upper three strings and lower three strings.

Week 3 content: Arpeggio technique, C major octave scale practice, degrees in major tonalities, chord structures and names, form knowledge, cadence types, classical piece transcription and practice, piece analysis, accompanying the piece with block chords.

Week 4 content: C major scale practice in the second position, chord practice, authentic C major cadence, school song, analysis, chord identification, creation of accompaniment patterns.

Week 5 lesson content: Technical exercises, popular song in C major, block chord practice.

Week 6 lesson content: Technical exercises, degrees in minor keys, chord structures and names, harmonic A minor scale practice, chord practice, classical piece, analysis of the piece, accompaniment practice with block chords.

Week 7 lesson content: School song in A minor, finding chords, analysis, playing with accompaniment patterns.

Week 8 lesson content: Rhythm beats, beat exercises, rhythm exercises with chords.

Week 9 lesson content: Popular song in A minor, working on the song with accompaniment models, playing the songs learned in previous weeks again with rhythm.

Week 10 lesson content: Technical exercises, practicing a two-octave scale in G major, chord practice, practicing a full cadence in G major, practicing a classical piece, analyzing the piece, and practicing block chord accompaniment based on the chord structures identified in the analysis.

Week 11 lesson content: School song in G major, finding the chords, analyzing it, playing it with accompaniment patterns, working on a popular song.

Week 12 lesson content: Flageolet technique, technical exercises, working on a two-octave scale in E minor harmonic, chord work, E minor full cadence, working on a classical piece. Followed by analysis of the piece and block chord accompaniment practice with the chords found.

Week 13 lesson content: School song in E minor, finding chords, analysis and chord connections, playing the song with accompaniment patterns.

Week 14 lesson content: Do major authentic cadence, La minor, Sol major, and mi minor full cadence repetitions, playing all songs learned since the first lesson with arpeggios, block chords, and rhythmic accompaniment.

At the end of this process, the student is expected to learn and apply the following: posture, guitar/nail care, tuning, the locations and system of notes on the fretboard; tirando, apoyando, arpeggio, playing double/triple/quadruple notes, rhythm playing, flageolet, and glissando techniques. The student is expected to know the degree and chord structures in major and minor tonalities, cadence types, and learn

how to use this information when finding chords for songs, and to apply the playing skills they have learned or their existing knowledge in a coordinated manner.

Conclusion, Discussion, and Suggestions

In this study, an eclectic approach was used to propose a draft course content for the Guitar Education and Accompaniment course included in the YÖK Music Teacher Education Bachelor's Program, which was updated in 2018. Upon examining the course information packages of universities and the relevant literature, it was observed that the course in question largely focuses on imparting technical skills; however, there is a limited number of resources and materials that systematically integrate harmony, cadence, form knowledge, and accompaniment production processes. This situation has revealed the need for comprehensive content that will support prospective music teachers to use the guitar not only as a solo instrument but also as a functional accompaniment instrument in the school music repertoire.

The content outline developed in this study is based on a pattern that relates guitar education to theoretical knowledge and addresses theoretical knowledge and practice simultaneously and in mutual interaction. In the 14-week process, structured on a tonality basis, transitions were made between scale and technical exercises, classical guitar pieces, school songs, and popular songs in each tone studied. Based on the formal and harmonic analysis of these pieces and songs, skills in finding chords, analyzing cadence connections, and producing different accompaniment models were developed. Thus, the student's instrumental playing ability is approached not only from a technical perspective but also as a cognitive activity where theoretical knowledge is applied.

Upon reviewing the literature, it is observed that Yungul (2008) systematically addresses the process of accompanying school songs through harmonic analysis, the identification of chord tones, and chord progressions; Tokatlı's (2024) study shows that lesson content progresses in a tonality-based structure; Özkasnaklı's (2023) study shows that supporting the process with materials is important. The difference between the content draft prepared in this study and the aforementioned studies is that it presents a more holistic approach, aiming not only to develop playing skills but also to enable students to create accompaniment through analysis and knowledge transfer.

This approach is expected to contribute to music teacher candidates' ability to use the guitar not only as a solo instrument but also as a functional accompaniment instrument in the context of school music. In this respect, the content is expected to enhance the holistic function of the course within the program and to develop teaching skills in terms of the transferability of the learned information to teaching processes.

Suggestions;

1. In all areas of instrumental music education, studies can be conducted on how existing knowledge is transferred to the instrument by incorporating the application of basic music theory knowledge.

2. The opinions of students taking Guitar Education and Accompaniment lessons can be gathered regarding the prepared content.

3. Action research can be conducted with students taking Guitar Education and Accompaniment lessons regarding the course content.

4. The use of the guitar in the professional lives of students taking the course and graduates can be examined.

5. Research can be conducted on knowledge transfer between courses offered in the field of music education.

6. Due to the development process of instrumental playing skills, the course duration can be extended from two semesters to three semesters.

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Appendix 1- The process of working on the school song

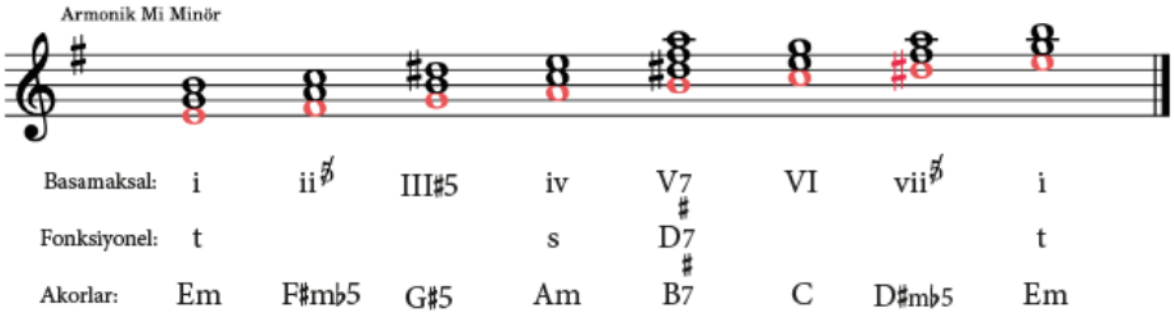


Yukarıda notaları verilen "Bu Dünya Bizim" şarkısının tonalitesinin belirlenebilmesi için öncelikle donanıma bakılmalıdır. Şarkının donanımında fa♯ değiştirici işareti bulunduğu için şarkının sol majör ya da mi minör tonunda olabileceği düşünülebilir. Bu durumda tonalitenin kesin olarak belirlenebilmesi için şarkının başlangıç ve bitiş seslerine bakılmalıdır.

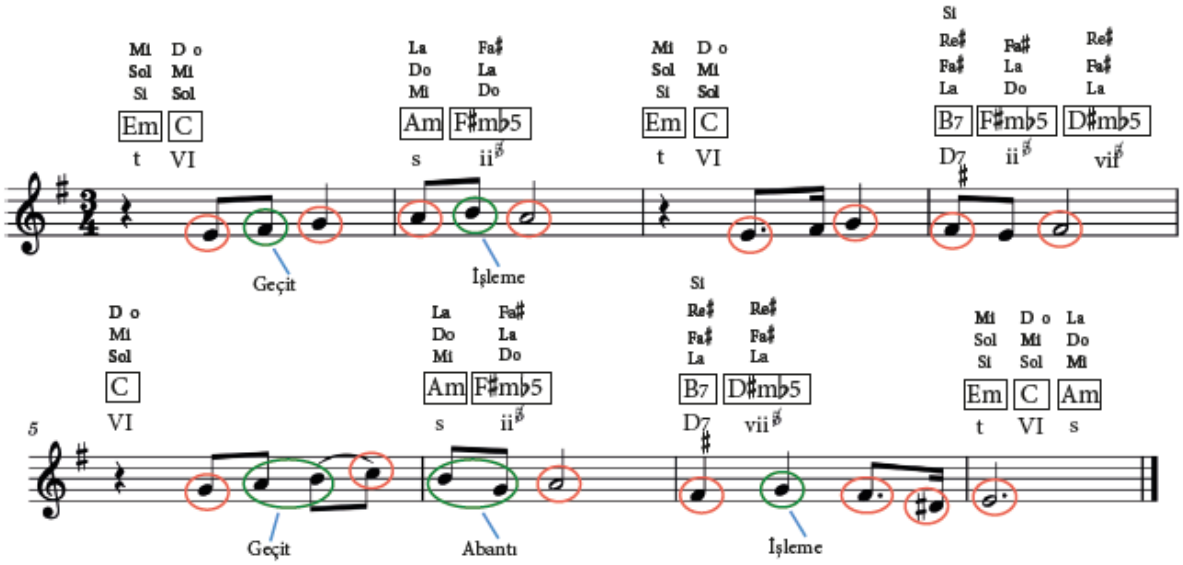
Şarkının 1. ölçüsü mi sesiyle başlamış; son ölçüsü de mi sesiyle bitmiştir. Bu durumda şarkının mi minör tonalitesinde olduğu belirlenmiş olur.

Şarkının tonalitesinin daha iyi anlaşılabilmesi için şarkının akıcı bir tempoda çalınması önemlidir. Böylece melodi için daha uygun akor tercihleri yapılabilir.

Mi minör tonalitesinde yer alan akorlar ve bunların dereceleri aşağıda gösterilmiştir:



"Bu Dünya Bizim" şarkısının notalarıyla ilişkili akorlar belirlenmiş ve aşağıda gösterilmiştir:



Şarkının armonik analizine göre ölçü içerisindeki işaretli notaların tonalitede yer alan birden fazla akorda bulunduğu görülmektedir. Akorlar belirlenirken ilgili ölçüde yer alan seslerin ortak olarak yer aldığı akorlar tercih edilmiştir. Şarkı eşliğinde bu akorlardan hangilerinin kullanılacağına karar verebilmek için şarkı çalınırken ya da söylenirken akor sesleri duyurulabilir ve uygun olduğu düşünülen akorlar belirlenerek kullanılabilir. Ayrıca bu aşamada bazı teorik bilgilerden yararlanmak faydalı olacaktır.

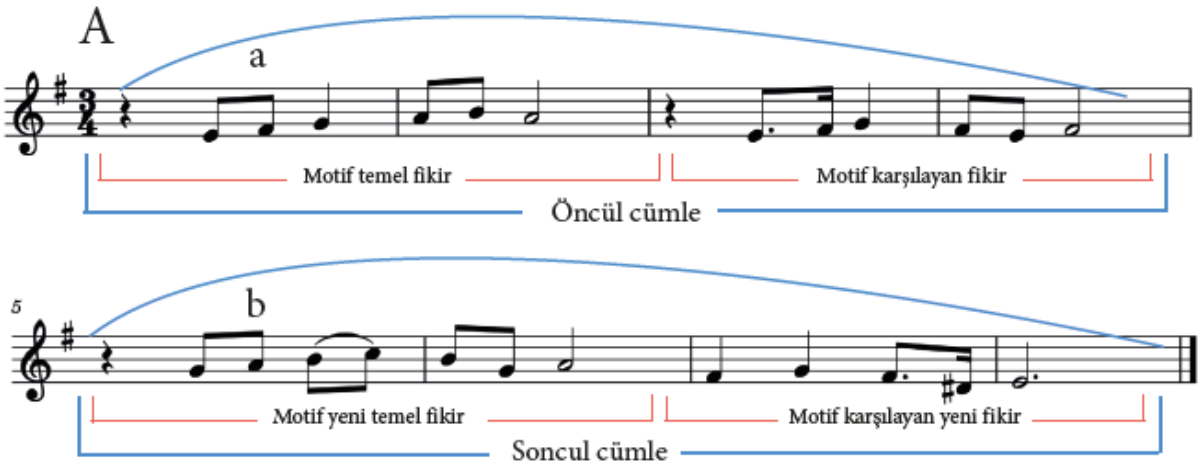
- Şarkıların başında ve sonunda istisnai bir durum olmadıkça tonalitenin merkez akoru kullanılır. Buna göre şarkısının 1 ve 8. ölçülerinde tonik akoru kullanılacağı için diğer akorlar elenebilir.
- Şarkının 2. ölçüsünde yer alan la sesi ii. derece akorunda bulunmasına karşın, 3. ölçüde Tonik akoru uygun olacağından, 2. ölçüde subdominant akoru kullanılabilir.
- Müzik eserlerinde öncül cümleler genellikle yarım kadansla bitirilir. Bu durumda şarkının 4. ölçüsündeki fa♯ sesi için dominant akoru kullanılarak otantik yarım kadans yapılabilir.
- Şarkının 5. ölçüsü için VI. derece akoru; 6. ölçüsü için subdominant akoru; kadans bölgesi olan 7. ölçüsü için dominant akoru ve son ölçüde tonik akoru kullanılarak soncul cümle için tam kadans yapılabilir.

"Bu Dünya Bizim" şarkısı için kullanılabilecek akorlar, şarkının form analizi ve akor bağlantıları aşağıda gösterilmiştir:

Bu Dünya Bizim-Akorlar



Bu Dünya Bizim-Form Analiz



Bu Dünya Bizim-Akor Bağlantıları




Bu Dünya Bizim-Eşlik Modelleri
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3. Eşlik
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Design and Assess a Professional Development Program on AI, Robotics, 3D Design and 3D Printing for Early Childhood Education to Empower Educators Include Active Citizenship for Sustainable Development

Anthoula Maidou[104], Sofia Chatzigeorgiadou[2], Evangelia Oikonomou[3], Hariton Polatoglou[4], Maria Rellou[5] & Aikaterini Spitsa[6]

Abstract

This paper presents the design and assessment of a professional development program titled "Training Kindergarten and Primary 1st Grade Teachers with Robotics and Digital Tools in Natural Sciences, Sustainability, and Active Citizenship." Designed in response to the increasing need for digital transformation in early childhood education, the program aimed to foster pedagogical innovation through the integration of emerging technologies and active, socially responsive teaching methodologies. It provided a structured yet flexible training experience for in-service teachers, emphasizing cross-curricular design, sustainability, and civic engagement.

The program was implemented from March 6 to May 17, 2025, encompassing 30 hours of blended learning. Its structure reflected a well-balanced combination of synchronous theoretical sessions, in-person, hands-on workshops, and asynchronous engagement on the Moodle platform. The asynchronous component featured curated educational resources, readings, assignments, and a final submission of an original teaching activity, closing with an online dissemination session to enable participants to present their work, reflect on their learning, and exchange ideas with peers.

The assessment framework for the program was both formative and summative. It included pre- and post-program surveys, participant reflections, peer review of project work, and qualitative analysis of the final activity plans. Data collected indicated high levels of satisfaction and engagement among participants. Teachers reported increased confidence in using robotics, AI, and 3D design tools in their classroom practices. Moreover, they appreciated the emphasis on integrating digital tools into broader educational objectives, such as promoting sustainability and active citizenship.

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A particularly innovative aspect of the program was its socio-pedagogical framing, which positioned digital tools not merely as technical instruments, but as enablers of civic participation, ecological awareness, and creative expression. By combining 3D digital design and robotics with themes such as sustainability and storytelling, the training addressed both curricular and societal challenges, aligning closely with 21st-century learning goals.

Participants expressed a strong interest in follow-up activities, including ongoing professional learning communities, mentorship opportunities, and advanced training modules. They also recommended the issuance of micro-credentials or digital badges as formal recognition of their newly acquired skills.

Keywords: Professional Development, Early Childhood Education, Robotics, 3D design, Active Citizenship.

Introduction

The rapid evolution of technologies such as Artificial Intelligence (AI), Robotics, and Additive Manufacturing (3D Printing) necessitates a fundamental shift in educational paradigms, particularly in Early Childhood Education (ECE). ECE is the crucial foundation where children develop foundational digital literacy, critical thinking, and socio-emotional skills. However, a significant gap often exists between the pace of technological innovation and the preparedness of in-service teachers to effectively integrate these tools.

Addressing this gap requires professional development (PD) programs that move beyond mere technical proficiency. They must embed technology within broader pedagogical frameworks that emphasize Sustainable Development Goals (SDGs) and Active Citizenship. This integration positions emerging technologies not as standalone subjects, but as powerful instruments for solving real-world problems and fostering social responsibility.

This paper details the design, implementation, and assessment of a PD program tailored for Kindergarten and Primary 1st Grade teachers. The program aimed to cultivate pedagogical innovation by equipping educators with the skills to confidently and creatively integrate AI, Robotics, and 3D design into their practice, focusing on cross-curricular activities that promote sustainability and civic engagement.

Literature Review

Early Childhood Education

The early years of life represent a pivotal stage in human development, exerting a profound influence on individuals' lifelong trajectories in relation to learning, social participation, and employment. During this period, foundational dispositions such as curiosity, creativity, and resilience begin to emerge, shaping children's capacity to engage meaningfully with their environment and to construct knowledge through interaction and experience. Accordingly, early childhood education is increasingly acknowledged as a determinant of later academic achievement and social well-being, underscoring the necessity of well-structured, developmentally appropriate curricula.

In contemporary educational policy, school curricula are designed to endow learners with the competencies required for personal fulfillment, social inclusion, active citizenship, and employability within an evolving, knowledge-based society (Council of Europe, 2018). The implementation of this agenda necessitates an integrated approach to learning that cultivates four interrelated categories of skills: (a) *learning skills*, encompassing critical thinking, collaboration, and problem-solving; (b) *life skills*, which include communication, empathy, and adaptability; (c) *technology and science skills*, essential for navigating digital and scientific domains; and (d) *mind skills*, such as self-regulation, metacognition, and reflective awareness. This framework is consistent with the Global Sustainable Development Goal Indicators (IAEG-SDGs, 2017), which position education as a central mechanism for fostering sustainable development and global citizenship.

Recent research in early childhood education and pedagogy emphasizes the importance of extending and enriching children's scientific understanding as well as their holistic modes of knowing and being in the world (Campbell & Jobling, 2021; Kalogiannakis et al., 2018). Studies demonstrate that learning experiences that integrate inquiry, experimentation, and reflection promote conceptual understanding and positive attitudes toward science and technology. Furthermore, empirical evidence suggests that the early years of formal education - particularly kindergarten and the first grade - constitute a critical period for the development of scientific reasoning and inquiry skills, which serve as precursors to later achievement in STEM-related domains (Curran & Kitchin, 2019; McClure et al., 2017).

Within the context of the Greek educational framework, the curriculum explicitly highlights the importance of engaging young learners in scientific exploration and technological experimentation. It promotes active participation through hands-on, inquiry-based learning experiences that encourage children to observe, question, predict, and test their ideas. This pedagogical orientation aligns with constructivist and sociocultural theories of learning, which emphasize the co-construction of knowledge through interaction and dialogue. By fostering curiosity and agency in scientific inquiry, early childhood

educators lay the groundwork for lifelong learning, supporting children in developing cognitive competence and an enduring sense of wonder about the natural and technological world.

A substantial body of research underscores the transformative potential of new technologies in early childhood and primary education, particularly in fostering higher-order cognitive processes, creativity, innovation, and collaboration among young learners (Hatzigianni et al., 2018; Falloon, 2020; Giezma et al., 2013; Loveless, 2008). Digital tools and technological applications may provide opportunities for children to acquire basic digital literacy skills and to engage in complex problem-solving, to communicate ideas through multiple modalities, and to co-construct knowledge within social and collaborative contexts. Such environments stimulate metacognitive awareness and enhance learner agency.

In the 21st century, children of preschool and early school age are developing within an environment of rapid technological evolution, a fact that necessitates the acquisition of contemporary competencies for solving innovative, complex, and "ill-structured" problems (Tsai et al., 2023). The systematic integration of technology into the educational framework is considered pivotal for the effective preparation of students to meet the demands of the modern labor market (Aslan, 2023). Consequently, educators are required to adopt teaching methodologies that are student-centered and technologically integrated.

Within this evolving educational landscape, design thinking has emerged as a pedagogical framework that leverages the mindset and methodologies of professional designers to cultivate creativity and innovation in learning (Fierst et al., 2011). It constitutes a fundamental approach for deepening the understanding of problems, evaluating potential solutions, and redefining them toward the development of novel approaches (Yalçın, 2022). Simultaneously, it enhances problem-solving capabilities and strengthens learning motivation (Tsai et al., 2023). Design thinking encourages learners to approach challenges empathetically, explore multiple perspectives, and iteratively develop solutions to authentic problems. It is a non-linear, abductive process that emphasizes inquiry, experimentation, and reflection (Chatzigeorgiadou et al., 2022; Kimbell, 2016; Siang, 2017).

The design thinking methodology unfolds through a sequence of five distinct stages: empathize, define, ideate, prototype, and finally, test (Yalçın, 2022). Through its stages—typically empathy, definition, ideation, prototyping, and testing—design thinking engages children in cycles of exploration and creation that mirror authentic learning processes and promote deeper understanding.

From a pedagogical standpoint, design thinking aligns closely with the aims of 21st-century education, as it encourages learners to think critically, act creatively, and collaborate effectively in diverse contexts. It provides a flexible, human-centered approach to teaching and learning that adapts well to the complexities of modern classrooms, where students are increasingly expected to navigate interdisciplinary knowledge and digital environments. Importantly, it situates problem-solving within meaningful, real-world contexts, thereby enhancing the relevance of learning experiences and motivating students to apply their ideas to tangible outcomes. Furthermore, its integration into school curricula, especially those related to the Sustainable Development Goals (SDGs), is linked to the development of ethical values and a responsible attitude (Mulyasari, Ali, & Sukirman, 2021).

Recent research highlights the integrative potential of design thinking within STEM and STEAM education, suggesting that it can serve as “a natural bridge between subjects… focusing on the integration of computational thinking and computational making approaches within the STEM education environment” (Juškeviciene et al., 2021, p. 210). By linking computational processes with creative design, design thinking supports both technical and imaginative dimensions of learning, allowing children to engage simultaneously in analytical reasoning and creative exploration. This synthesis promotes a holistic understanding of problem-solving, one that values both structured logic and open-ended innovation.

In this regard, design thinking can be viewed not merely as a set of pedagogical strategies, but as a broader educational philosophy that fosters adaptive expertise and prepares young learners for participation in a rapidly changing, technology-driven world. Its focus on empathy, iteration, and collaboration resonates with contemporary educational imperatives emphasizing inclusivity, sustainability, and lifelong learning.

The combination of design thinking with constructivist teaching strategies increases learning motivation and empowers students, even at an early age, to address complex problems (Tsai et al., 2023). Furthermore, its early application acts as a preventative mechanism against the passive acceptance of knowledge, cultivating self-confidence and preparing for lifelong learning.

Problem-solving constitutes a fundamental cognitive and metacognitive skill, crucial for fostering children's autonomy, self-esteem, and learning self-efficacy. Within the context of the 21st century skills, the ability to recognize, analyze, and address complex problems is intricately linked to the development of critical thinking, creativity, collaboration, and effective communication (McClure et al., 2017; Fusaro & Smith, 2018). Consequently, the utilization of educational strategies based on students' active engagement in authentic scenarios, such as Problem-Based Learning (PBL), is deemed particularly effective, even in primary education.

To this end, the combined application of design thinking and 3D Printing provides a unique opportunity to bridge the learning environment with authentic environmental issues, deepening the understanding of real-world problems (Fokides, Lagopati, 2024). 3D Printing aligns with the principles of constructivist and inquiry-based learning, enabling children to translate ideas into tangible objects. This enhances creativity, active participation, and the conceptual understanding of geometric and scientific concepts (Aslan, 2023; Tsai et al., 2023), while also providing critical stimuli for the development of mathematical thinking through spatial reasoning and measurement (Lehrer & Schauble, 2015). Furthermore, project-based activities, such as constructing ecosystem models, foster interdisciplinary learning (Sullivan & Heffernan, 2016).

Concurrently, educational robotics, utilizing tools like the Bee-Bot floor robot, promotes cognitive and socio-emotional development in playful contexts. Using robotics, children develop computational and algorithmic thinking, as well as problem-solving skills (Bers et al., 2014), reinforcing the understanding of basic programming concepts, such as sequencing. However, the successful integration of robotics in preschool settings necessitates appropriate pedagogical guidance and authentic learning frameworks (Papadakis et al., 2019). Finally, the integrated utilization of these tools contributes to the development of social and cultural competencies, as students engage in projects (e.g., related to the Sustainable Development Goals - SDGs) assuming roles as active citizens (Mulyasari et al., 2021).

Method

The methodological foundation of the PD program was grounded in the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2008; Voogt et al., 2012), which acknowledges that the effective integration of technology in education requires a dynamic interplay among three key domains of teacher knowledge: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). The intersection of these domains generates an adaptive form of expertise that enabled teachers to design meaningful learning environments in which technology serves as a catalyst for children's understanding, creativity, and inquiry. The choice of TPACK as the guiding framework responds to the imperative need for digital transformation in Early Childhood Education (ECE), as emerging technologies, such as Artificial Intelligence (AI), Educational Robotics, and 3D Design/Printing, demand that teachers are technologically proficient and capable of integrating these tools in pedagogically sound and developmentally appropriate ways.

The PD program moves beyond the acquisition of technical skills toward a model of pedagogical innovation and social responsibility, where technology was intertwined with the goals of sustainable development and active citizenship. Specifically, the program aims to achieve three key objectives: (a) Technological Integration, by embedding Robotics, AI, and 3D tools into Natural Science learning activities; (b) Cross-Curricular Design, by promoting interdisciplinary connections and creative collaboration across Kindergarten and Primary Grade 1; and (c) Social Connection, by empowering educators to promote active citizenship, democratic participation, and environmental awareness among young learners through digital tools. Thus, the TPACK framework functioned both as a theoretical lens and a practical guide, supporting reflection, collaborative learning, and continuous professional growth for educators as they navigated the challenges and opportunities of the digital age.

Implementation and Structure

The Professional Development (PD) program was implemented between March 6 and May 17, 2025, engaging 30 in-service early childhood and first-grade educators (2 men and 28 women). Designed according to blended-learning principles and constructivist models of professional growth, the program emphasized iterative engagement, hands-on experimentation, and collaborative meaning-making approaches consistently supported in the literature on technology-enhanced early childhood education and educator development (Aslan, 2023; Bers et al., 2014; Papadakis et al., 2019; Yalçın, 2022). Its implementation unfolded through several interconnected phases that combined online theoretical preparation, asynchronous multimodal learning, and face-to-face collaborative workshops, fostering both conceptual understanding and applied pedagogical competence.

The initial phase consisted of four hours of synchronous online meetings delivered via Zoom. During these sessions, participants explored foundational theoretical concepts related to design thinking, computational thinking, robotics, artificial intelligence, and 3D design. Establishing this shared conceptual grounding was essential for ensuring coherence and confidence as educators prepared to work with emerging technologies. This emphasis on explicit theoretical scaffolding aligns with research demonstrating that early conceptual clarity enhances educators' readiness and pedagogical decision-making when integrating STEM and digital tools in early childhood settings (McClure et al., 2017; Papadakis et al., 2019; Tsai et al., 2023).

Following the synchronous sessions, educators engaged in ten hours of asynchronous online learning hosted on Moodle. This phase provided access to multimedia materials, readings, self-paced assessments, and reflective tasks. Asynchronous digital environments support autonomy, flexible engagement, and deeper cognitive processing conditions shown to strengthen teacher learning and reflective practice (Falloon, 2020; Loveless, 2008). The Moodle modules introduced essential principles of AI literacy, the basics of educational robotics, foundational 3D design concepts, and inquiry-based strategies for promoting STEM learning. Such exposure is particularly important, as studies have shown that both pre-service and in-service teachers often lack opportunities to explore 3D technologies and robotics in structured professional learning contexts (Aslan, 2023; Fokides & Lagopati, 2024).

The eight-hour in-person hands-on workshops constituted the most impactful and transformative component of the program, according to participant feedback. Working in small groups, educators engaged directly with robotics kits, introductory AI tools, 3D design platforms, and sustainability-oriented design challenges. Constructionist, hands-on learning experiences are widely recognized for fostering confidence, creativity, and pedagogical imagination among early childhood educators (Bers et al., 2014; Sullivan & Heffernan, 2016). These workshops followed iterative design thinking cycles, inspired by the models of Fierst et al. (2011) and Siang (2017), involving empathic problem definition, ideation, prototyping, and classroom-oriented testing. Participants co-designed learning activities that addressed authentic pedagogical needs—an approach strongly supported in the literature on collaborative and inquiry-driven STEM learning (Lehrer & Schauble, 2015; Juškevičiene et al., 2021; Chatzigeorgiadou et al., 2022). The hands-on exploration also resonates with evidence on young children's natural inquisitiveness and the importance of problem-solving-rich environments in early education (Fusaro & Smith, 2018), reinforcing the rationale for educators' active engagement with open-ended STEM materials.

Following the workshops, educators collaborated in teams of three to five to design an original interdisciplinary teaching scenario that integrated robotics, AI, and 3D design or printing with principles of active citizenship and sustainable development. This project-based creation task, estimated to require six hours, aligns with research emphasizing that authentic design activities are crucial for transferring newly acquired professional learning into meaningful classroom practice (McClure et al., 2017). The integration of sustainable development themes further reflects pedagogical frameworks advocating for early cultivation of civic responsibility and character formation through SDG-oriented school programs (Mulyasari et al., 2021).

The program culminated in a plenary presentation, where all groups shared their completed activities with peers and an external observer. This final stage reinforced the formation of a professional learning community, encouraging reflective dialogue, peer feedback, and metacognitive awareness. Such collaborative and democratic professional practices are associated with sustained pedagogical

transformation and long-term innovation adoption (Council of Europe, 2018; Yalçın, 2022). Moreover, the process contributed to educators' growing competence in computational and algorithmic thinking, domains increasingly recognized as essential in early childhood education.

A distinctive feature of the program was its integration into two official European Code Week alliances, which broadened educators' participation in international STEM and coding initiatives. This involvement situated their work within a wider community of practice and strengthened their engagement with global digital literacy movements. Additionally, participants contributed to two collaborative Padlet boards—one for robotics and one for 3D design—allowing them to document ideas, prototypes, and reflections throughout the program. Such shared digital spaces align with research highlighting the value of collaborative documentation and digital interaction for enhancing creativity, communication, and reflective practice in STEM education (Giezma et al., 2013; Grammenos, 2016; Hatzigianni et al., 2018). The combination of immersive hands-on experience, collaborative design, and participation in broader digital learning initiatives positioned the PD program as a robust model for preparing educators to integrate emerging technologies meaningfully and responsibly into early childhood education.

Data Analysis

A comprehensive assessment framework, incorporating both formative and summative elements, was designed to obtain a multidimensional understanding of participants' learning progress as well as the overall impact of the program. This framework combines quantitative and qualitative approaches, ensuring that the evaluation captures not only measurable shifts in knowledge and competence, but also deeper reflections, attitudes, and changes in pedagogical practice.

From a quantitative perspective, pre- and post-program surveys serve as the primary tool for gathering measurable data. These surveys are administered at the beginning and the end of the program to document changes in participants' confidence, perceived competence, and familiarity with key concepts. By comparing the results, it is possible to identify areas where participants have experienced significant growth, as well as topics that may require further support or refinement in future iterations of the program. Trends emerging from these surveys offer valuable insights into the program's overall effectiveness and its ability to empower participants in specific pedagogical or technological domains.

Complementing the numerical data, a series of qualitative assessment methods provide a richer and more nuanced picture of participants' learning experiences. Participants' reflections allow individuals to articulate their personal journeys, highlighting moments of insight, challenges encountered, and the ways in which the program influenced their thinking or teaching practice. These reflective narratives reveal dimensions of learning that cannot be captured through numbers alone, helping us understand how participants internalize and apply new concepts.

In addition, a structured peer-review process was integrated into the assessment framework, applied during the final presentation of the trainees groupwork. Through this process, participants evaluate each other's final assignment and provide constructive feedback based on the following criteria: 1. Clarity and Structure of the Presentation, 2. Content Quality, 3. Pedagogical Integration, 4. Integration of Technological Tools, 5. Originality and Creativity. This not only enhances the quality of the assignments, but also promotes collaborative learning, critical engagement, and a shared sense of responsibility within the learning community.

Finally, the qualitative analysis of the final teaching activity offers a holistic view of participants' ability to synthesize and apply what they have learned. By examining elements such as instructional design, pedagogical choices, integration of technology, and alignment with learning objectives, we assessed how effectively participants translated theory into practice. This final analysis provided concrete evidence of skill development and highlighted the degree to which participants were prepared to implement new strategies in their professional contexts.

Findings

Padlet served for both parts of the program, the robotics part of the course (Figure 1) and for the 3D design part. Working in groups of 3-5 trainees, they exhibited there the steps of the design thinking process they followed, which led to their final artefact.

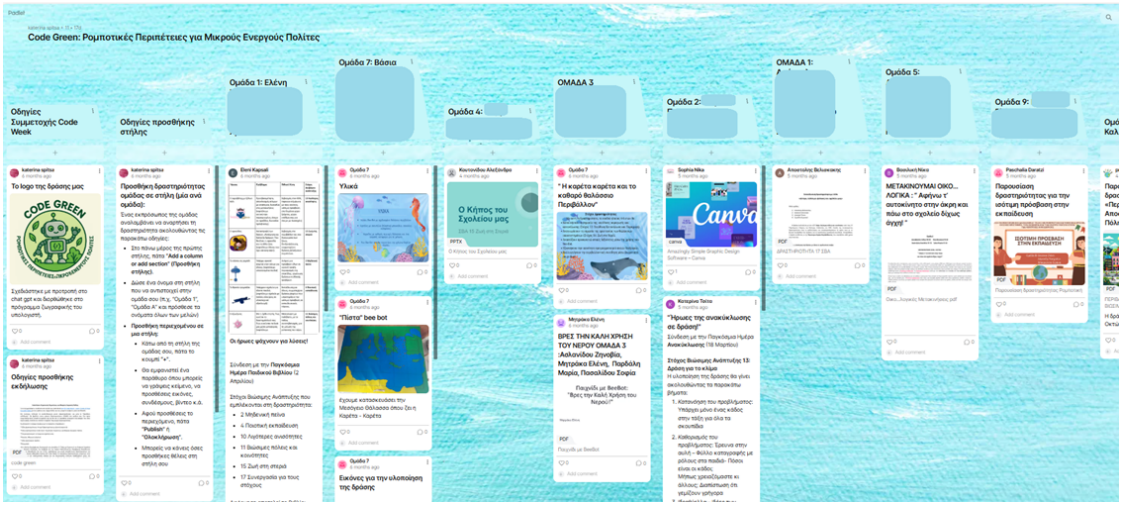


Figure 1. *Snapshot of the Padlet used for the robotics part of the course*

The same method, the design thinking process as the main pedagogical approach was applied also for the 3D design part of the PD program, as depicted in Figure 2, and the main steps are again presented by each group in the relevant Padlet.



Figure 2. *Snapshot of the Padlet used for the 3D design part of the course*

All participants should apply the process in their class with their pupils, and report about it on the CodeWeek Platform. This was unfortunately not done during, or shortly after the PD program, because the time frame was already close to the ending of the school year, and most teachers preferred to start the project during the next school year, with more time available.

Below we will present a thematic analysis based directly on the participants' answers to some open-ended questions from the final questionnaire, which we considered being the most important. We identified the recurring themes, grouped them, and added a short analytical interpretation for each on the Emotional Responses about the PD program, what practical changes they would apply in their

teachings after the program, and what challenges they identify in implementing active citizenship activities in their classroom and how they plan to address them.

Thematic Analysis of Participants' Emotional Responses

Table 1.
Codes, Categories and Themes from the Emotional Responses of the Participants

Codes	Categories	Themes
excitement, curiosity, motivation, interest in new topics, eagerness to learn	Initial positive anticipation	Initial Enthusiasm and Curiosity
anxiety, fear of technology, insecurity, lack of confidence, uncertainty, hesitation	Early-stage emotional barriers	Anxiety, Uncertainty, or Lack of Confidence at the Start
confusion, frustration, unclear instructions, unmet expectations, communication issues	Organizational and structural challenges	Experiences of Confusion or Organizational Challenges
increased confidence, competence, empowerment, self-efficacy, technological mastery	Emotional and cognitive transformation	Growth in Confidence and Competence
inspiration, renewal, sense of purpose, professional evolution, broadened perspective	Professional identity and pedagogical growth	Personal and Professional Development
teamwork, collaboration, group support, positive climate, sense of community	Collective learning and interpersonal support	Importance of Collaboration and Community
satisfaction, fulfilment, "meaningful learning," usefulness, positive closure	Positive end-of-program emotional outcome	Satisfaction and Fulfilment at Completion
unmet expectations, ambivalence, heavy workload, mixed feelings, partial dissatisfaction	Divergent or ambivalent emotional outcomes	Mixed or Ambivalent Experiences

1. Initial Enthusiasm and Curiosity: Many participants reported entering the program with enthusiasm, interest, and a desire to learn something new (e.g., environmental education, robotics, 3D design, active citizenship). This positive anticipation reflects the intrinsic motivation of educators to expand their skills and engage with innovative pedagogical approaches. This initial excitement indicates that the program's topics aligned well with teachers' professional interests. High motivation at the beginning is a strong predictor of engagement and persistence in professional development contexts.

2. Anxiety, Uncertainty, or Lack of Confidence at the Start: A significant number of participants described feelings of anxiety, insecurity, or doubt, especially regarding their ability to handle unfamiliar technologies such as robotics, 3D designs, or AI. These emotions reveal a common challenge in training programs involving emerging technologies. Early insecurity often stems from a perceived gap between teachers' prior knowledge and program expectations. This finding highlights the importance of scaffolding, early clarity, and reassurance at the beginning of the program.

3. Experiences of Confusion or Organizational Challenges: A smaller but notable group (two persons) reported confusion, frustration, and feelings of poor communication. For two participants expectations were not fully met. These responses point to a need for clearer structure, more streamlined communication, and stronger instructional design. Even when content is valuable, inconsistencies in organization can negatively influence participants' emotional experience. Their feedback indicates areas where program coordination could be strengthened.

4. Growth in Confidence and Competence: Across the dataset, a dominant theme is the shift from initial uncertainty to confidence, self-efficacy, and empowerment. Many participants reported that by the end, they felt more capable of designing activities, implementing new technologies, and applying the concepts in their teaching practice. This transformation is a key indicator of a successful professional development program. Participants not only gained knowledge but also internalized it in a way that increased their ability to act, reflecting deep learning and perceived relevance.

5. Personal and Professional Development: Several participants noted feelings of inspiration, renewal, growth, and professional evolution. They mentioned that the program opened "a new window" into the future of education, gave them ideas, and expanded their pedagogical capacities. These responses highlight the program's impact beyond technical skill-building. It contributed to teachers' identity, pedagogical orientation, and sense of professional purpose, indicators of meaningful long-term change.

6. Importance of Collaboration and Community: Many participants emphasized the value of teamwork, collaboration, and the creation of a supportive learning community. They described the group climate as positive, inspiring, and emotionally supportive. The collaborative components of the program had a strong positive emotional impact, reinforcing the idea that professional learning is more effective when embedded in community structures. Shared experiences improved confidence and strengthened engagement.

7. Satisfaction and Fulfilment at Completion: Most participants ended the program feeling satisfied, happy, and fulfilled. They described the learning as meaningful, applicable, and empowering. Even those who faced challenges acknowledged that the knowledge gained was useful. High end-of-program satisfaction indicates that despite organizational or workload concerns, the overall learning experience was viewed positively and generated practical value. This suggests strong program outcomes and transfer of learning to professional practice.

8. Mixed or Ambivalent Experiences: A few participants (2 people) reported that the program did not fully meet their expectations or that they did not gain what they had hoped. Others felt that the duration or workload was demanding. These mixed responses provide valuable insights into content-depth balance and workload management. They suggest areas where clearer expectations, additional support, or differentiated pathways may enhance future iterations.

The overall emotional trajectory of participants shows a shift from initial curiosity and anxiety to confidence, satisfaction, and professional empowerment. The strongest positive impacts were linked to collaborative learning, hands-on experiences, and practical application. Negative emotions primarily stemmed from organizational challenges or perceived mismatches between expectations and content delivery.

Thematic Analysis of Participants' Responses on what they will change in their teachings

The analysis is based on all participants' answers and is structured around six major themes that describe the practical changes they intend to implement in their teaching.

Table 2.
Codes, Categories and Themes on what they will Change in their Teachings

Codes	Categories	Themes
applying Design Thinking, problem identification, solution development, inquiry stages, ideation, prototyping, evaluation, fostering creativity, collaboration, critical thinking	Inquiry-based and student-centered methodologies	Systematic Integration of Design Thinking
using Bee-Bot, STEAM kits, robotics integration, cross-curricular robotics projects, participation in CodeWeek, robotics for problem-solving	Technology-supported hands-on learning	Increased Use of Educational Robotics

Codes	Categories	Themes
introducing 3D design tools, student 3D modeling, classroom 3D printing, producing artifacts, visualizing ideas	Innovative digital fabrication practices	Introduction of 3D Design and 3D Printing
sustainability as mindset, SDGs integration, linking lessons to environmental and social issues, real-world problem contexts	Sustainability-oriented curriculum redesign	Embedding Sustainability More Systematically
activities of active citizenship, democratic participation, dialogue, collaboration, initiative-taking, critical decision-making	Civic engagement and democratic classroom culture	Promotion of Active Citizenship and Democratic Participation
systematic use of ICT, creating interactive digital tasks, enhancing engagement through technology, digital creativity	Digital transformation of teaching	Expanded Use of Digital Tools and ICT

1. Systematic Integration of Design Thinking: This is the strongest and most frequent theme. Participants state they will: Apply Design Thinking more regularly and systematically, design projects where students identify real problems and develop solutions, use the stages of inquiry, ideation, prototyping, and evaluation, foster creativity, collaboration, and critical thinking. As a practical change, teaching becomes more inquiry-based, student-centered, and solution-focused.

2. Increased Use of Educational Robotics: Participants report that they will integrate robotics more frequently, use robotics in cross-curricular projects, participate in initiatives such as CodeWeek, use robotics to strengthen problem-solving and engagement. In this way robotics becomes a regular instructional tool, not an occasional activity.

3. Introduction of 3D Design and 3D Printing: Many participants intend to introduce 3D design tools in class, guide students in creating their own 3D models, use school 3D printers to produce artifacts and support learning. As a practical change, 3D design is adopted as an innovative medium for modelling, creativity, and problem solving.

4. Embedding Sustainability More Systematically: Participants express that they will integrate sustainability not only as a topic but as a mindset and way of teaching, link activities to real-life environmental and social issues, connect learning tasks to the SDG. Thus, sustainability becomes a cross-curricular lens shaping lesson design and classroom culture.

5. Promotion of Active Citizenship and Democratic Participation: Educators intend to include more activities that develop students' active citizenship, encourage participation, collaboration, dialogue, and initiative-taking, strengthen critical thinking and decision-making. Thus, the classroom becomes more democratic, participatory, and socially oriented.

6. Expanded Use of Digital Tools and ICT: Participants state that they will use digital tools more systematically in the learning process, create interactive digital tasks and projects, enhance student engagement and creativity through technology. Thus, teaching becomes more interactive, technology-enhanced, and digitally rich.

Overall, the training program led to intentions for multi-level practical change in teaching practice: A. Pedagogical transformation: Shift toward student-centered, experiential, collaborative learning (Design Thinking, problem solving, active participation). B. Technological enhancement: Increased use of robotics, 3D design, and digital tools as core instructional methods. C. Thematic focus on sustainability and citizenship: Teaching aligned with SDGs, active citizenship, and real-world problem solving.

Thematic Analysis of Participants' Responses on what they will change regarding the challenges of implementing active citizenship actions in the classroom and their proposed solutions.

Based on the responses provided several key themes regarding the challenges of implementing active citizenship actions in the classroom and their proposed solutions were identified (Table 3).

Table 2.
Codes, Categories and Themes regarding the challenges of implementing active citizenship actions in the classroom and their proposed solutions were identified

Codes	Categories	Themes
lack of time, overloaded curriculum, limited time for new activities	Time-related pressure	Structural and Logistical Challenges
insufficient materials, lack of funding, inadequate equipment	Resource scarcity	Structural and Logistical Challenges
lack of administrative support, limited guidance, colleagues not engaged	Institutional/organizational gaps	Structural and Logistical Challenges
difficulty explaining abstract concepts (rights, responsibilities)	Cognitive limitations of young children	Developmental Appropriateness (Student Age & Maturity)
short attention spans, low concentration, limited maturity	Developmental readiness issues	Developmental Appropriateness (Student Age & Maturity)
students show indifference or limited understanding of citizenship actions	Engagement difficulties	Developmental Appropriateness (Student Age & Maturity)
parents show resistance, lack of interest, minimal involvement	Parental disengagement	Community and Parental Engagement
difficulty collaborating with municipality, lack of external partners, limited community support	External cooperation challenges	Community and Parental Engagement
need for training in modern pedagogies, need for differentiation skills	Need for pedagogical upskilling	Teacher Readiness and Professional Development
limited digital skills of teachers and students, lack of familiarity with digital tools	Digital literacy barriers	Teacher Readiness and Professional Development

The primary themes extracted from the analysis:

1. Structural and Logistical Challenges: The most frequently cited obstacles relate to the lack of time and resources required to implement these programs effectively. Time Constraints: Educators feel pressured by an already overloaded curriculum and daily schedule, leaving little room for new actions. Some viewed the new actions as time-consuming additions that detract from other activities. Resource Scarcity: There is a significant lack of material resources, funding, and infrastructure. In addition, participants noted a lack of guidance, organized structure, or support from the school administration and colleagues.

2. Developmental Appropriateness (Student Age & Maturity): A major theme is the difficulty of teaching abstract citizenship concepts to young children (preschool/first grade). Cognitive Limitations: Concepts like "rights," "obligations," and "decision-making" are difficult for young children to grasp theoretically. Attention and Maturity: Educators face challenges regarding the children's short attention spans, lack of maturity to understand different viewpoints, and occasional indifference.

3. Community and Parental Engagement: Successful active citizenship requires connection with the outside world, which presents its own set of hurdles. Parental Resistance/Indifference: It is often difficult to get parents to participate actively or support the school's actions. External Cooperation: There are difficulties in collaborating with the municipality, local bodies, or finding external partners.

4. Teacher Readiness and Professional Development: Need for Upskilling: Educators expressed the need to stay updated with modern teaching methods (e.g., differentiation, digital tools) to meet heterogeneous class needs. A lack of familiarity with digital tools by both teachers and students can hinder innovative activities.

Proposed Strategies and Solutions

The participants also provided specific themes on how they plan to overcome these challenges:

Pedagogical Adaptation (Experiential Learning): To address the age barrier, teachers plan to use role-playing, theatrical play, storytelling, and gamification to make concepts understandable. They aim to simplify concepts and link them to the children's daily lives.

Curriculum Integration: To solve the time issue, educators intend to integrate citizenship actions into existing subjects and daily routines rather than treating them as a separate subject.

Building Partnerships: Teachers plan to foster open communication with families from the start of the year and invite them to simple, practical actions (e.g., recycling, gardening) to build trust and engagement.

Utilization of Technology: Educators plan to utilize educational robotics, ICT, and digital tools to engage students and help them find solutions to problems.

Student Empowerment: Strategies include holding group councils and allowing children to take initiatives and design their own small-scale action plans.

Discussion, Conclusion, and Suggestions

The findings of the present professional development (PD) program highlight the growing importance of integrating emerging technologies, robotics, artificial intelligence, and 3D design/printing, into early childhood education (ECE). Teachers demonstrated increased confidence, engagement, and pedagogical competence when applying these tools within interdisciplinary and sustainability-oriented learning contexts. These results align with the broader literature emphasizing that early exposure to STEM experiences fosters curiosity, inquiry, and foundational problem-solving skills in young children (Fusaro & Smith, 2018; McClure et al., 2017). Teachers' strong engagement during hands-on sessions supports previous research showing that experiential, collaborative learning environments can deepen educators' understanding of developmentally appropriate STEM pedagogy (Lehrer & Schauble, 2015; Yalçın, 2022).

The meaningful integration of robotics and computational thinking activities observed in this program further resonates with established evidence. Robotics curricula have been shown to enhance young children's computational thinking, creativity, and engagement, often more effectively when learning is anchored in playful, inquiry-based pedagogies (Bers et al., 2014; Papadakis et al., 2019; Sullivan & Heffernan, 2016). Similarly, teachers' positive responses toward 3D design and printing reflect findings that these technologies promote hands-on exploration, interdisciplinary connections, and learner-centered design processes even in early childhood contexts (Aslan, 2023; Fokides & Lagopati, 2024). Importantly, participants valued the explicit link between digital technologies and broader social and environmental goals, reinforcing research that underscores the role of education in cultivating active citizenship and sustainability-related dispositions from an early age (Mulyasari et al., 2021).

In conclusion, this PD program appears to provide a scalable and effective model for empowering early childhood educators to meaningfully integrate emerging technologies through design thinking and socially responsible instructional frameworks. Its blended approach, combining synchronous instruction, asynchronous exploration, and intensive hands-on workshops, proved particularly impactful for strengthening both technological fluency and pedagogical innovation. These outcomes suggest that

high-quality, practice-based PD is essential for supporting teachers as ECE rapidly evolves to incorporate more complex technological and interdisciplinary expectations.

Building on these findings, several recommendations can be made. First, ongoing support structures such as professional learning communities, mentorship networks, and micro-credentialing systems could sustain teacher growth over time. Such structures align with global recommendations advocating continuous, reflective professional development in STEM and digital education. Second, future implementations may benefit from expanding opportunities for co-design, where teachers collaboratively create classroom activities that integrate robotics, 3D design, and sustainability themes. Third, additional research could examine the long-term effects of these PD experiences on teachers' classroom practices, children's learning outcomes, and the development of key competencies such as computational thinking, creativity, and ecological awareness. Finally, future studies may adopt longitudinal or mixed-method designs to capture how design thinking, constructivist learning, and wicked-problem pedagogies (Tsai et al., 2023) unfold in authentic classroom contexts.

Overall, the study contributes to a growing body of literature demonstrating that when early childhood educators are supported through purposeful, experiential, and interdisciplinary PD programs, they are better equipped to foster innovative, socially responsible, and future-ready learning environments for young children.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, all authors contributed to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Computer- Assisted Grammar Education

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Abstract

In recent years, technical developments in the field of computing have greatly influenced learning habits and learning styles. In the digital age, the increase in young people's use of mobile devices and the internet has made it necessary to adapt learning processes to technology. These technological developments have also led to a transformation in foreign language teaching. This digital transformation has particularly strongly affected three important areas of foreign language learning. One of these areas is "grammar and vocabulary exercises" (Funk 2016; Schmidt/Strasser 2018)[3] . Turkish students may experience difficulties when learning German, especially when learning grammar. This study was developed as part of a doctoral thesis conducted at the Department of German Language Education, Institute of Social Sciences, Trakya University, and is based on a research topic examining grammar learning among preparatory class students through digital exercises. The aim of the study is to examine the impact of computer-assisted digital materials on German grammar teaching. The sample of the research consists of preparatory class students at the Turkish-German University. In the study, 250 digital activities were prepared using the Wordwall and LearningApps applications to support the grammar topics in the "Netzwerk Neu A1–A2" book, and a 14-week application process was carried out. Data were collected using a triangulation method comprising pre-test–post-test organised according to a 3-point Likert scale, interviews with students, and classroom observations. Qualitative and quantitative methods were used together in the analysis of the data. In the quantitative analysis, the Wilcoxon signed-rank test was applied, and a significant increase in students' perceptions of digital material use was detected. Qualitative analyses revealed that, according to the majority of students, digital activities made learning enjoyable, enabled them to immediately identify their mistakes, and reinforced the rules. In conclusion, computer-assisted grammar teaching increases students' motivation to learn, makes abstract rules concrete, and supports repetition-based individual learning. In line with the research findings, it is recommended that digital exercises be integrated into the curriculum, gamification elements be increased, artificial intelligence-based materials be developed, and blended learning models be promoted.

Keywords: Computer-assisted learning, grammar teaching, German, digital education, German grammar digital exercises, digital learning technologies.

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Introduction

In Turkey, the topics of "German as a Foreign Language, German Grammar Teaching, Digital Media in German Lessons, and Preparatory Classes in Higher Education Institutions in Turkey" have each been addressed from different perspectives in numerous master's and doctoral theses. However, while numerous scientific studies address the use of digital media in German teaching, studies on grammar teaching in German at university level are still insufficient. Unlike these studies, this doctoral thesis focuses on digitalised grammar teaching in German lessons and attempts to develop computer-based teaching and learning materials to support grammar teaching in preparatory classes. It is thus thought that foreign language learners will be able to develop their foreign language skills better and more permanently.

Due to differences in language structures, learning German can be challenging for Turkish students, particularly in terms of grammar. Observations during the learning process indicate that students struggle to memorise grammar rules and apply them in production. Therefore, computer-assisted environments are considered to offer an important opportunity to make these abstract structures more concrete. For example, reinforcing verb order in sentences constructed with the conjunctions "weil" and "dass" through drag-and-drop activities can increase students' level of comprehension.

One of the aims of this study is to support and develop the grammar knowledge of students studying in preparatory classes at Türk-Alman University and learning German as a foreign language, with the help of digital media and materials. To this end, computer-based materials were developed within the scope of this study, and research was conducted to investigate and attempt to prove how the grammar knowledge of students learning German as a foreign language can be developed and improved through the use of computer-based materials prepared according to learning and teaching needs.

Another aim of this thesis is to investigate the extent to which computer-assisted materials and applications can contribute to developing the grammar skills of Turkish learners of German, while also identifying the difficulties this group encounters when using computer-assisted materials and applications for grammar learning and attempting to generate possible solutions to overcome these difficulties. Finally, it examines how computer-assisted materials and applications for grammar learning can be made more effective for students learning German in university preparatory classes.

Literature

For students in the digital age we live in, computers and smartphones have become an indispensable part of their daily lives. According to TÜİK's 2022 data ([4]), the percentage of households with internet access in Turkey is 94.1%. According to another report published by TÜİK in 2025[5] , 97.8% of young people aged 16–24 have used the internet regularly in the last three months. This situation has also been addressed by the Media Education Research Association Southwest (Der Medienpädagogische Forschungsverbund Südwest – abbreviated as "mpfs"), which has been conducting research in various fields in Germany for many years. Since 1998, research has been conducted on the media use of young people aged 12 to 19. These studies are referred to as the "JIM Study" (Youth, Information, Media). As a result of the work carried out by the organisation[6] in 2024, it was found that in 2024, almost all German households with young people aged 12 to 19 had a mobile phone and a computer or laptop. These data show that young people's access to digital tools is quite high in both Turkey and Germany.

The Coronavirus Pandemic that emerged in 2020 is seen as a factor that accelerated the use of digital environments in foreign language teaching. With the pandemic, a rapid digital transformation took place in almost all areas of life. People were forced to make changes in many areas, and numerous different measures were taken in almost all societal dimensions . As a result of these measures, school pupils and

[4]TÜİK 2022 Household-Information-Technology-(IT)-Usage-Survey
[5]TÜİK 2025 Household Information and Communication Technologies (ICT) Usage Survey
[6] mpfs, 2024, JIM Survey

university students, like many other people, were forced to stay at home and attend only online classes for a long time. This situation also affected the way classes were conducted, making it unthinkable today to teach without digital tools such as computers, tablets, and smartphones. As teaching and learning increasingly moved to the virtual environment, teaching and learning with digital media has become an indispensable part of foreign language teaching. With this development, the needs of students and the characteristics of foreign language teaching have also changed. Technical developments in the field of computers in recent years have also significantly affected learning habits and learning styles.

One of the topics of this thesis is the use of digital media in foreign language teaching. Digital media provides opportunities for information, interaction, communication, collaboration, and presentation. This allows students to move beyond being mere recipients and take an active role in the learning process. Furthermore, it is possible to learn specific learning situations individually, in a goal-oriented, fast, comprehensive and effective manner with computers (Mac, 2001, p. 92). Huneke and Steinig also emphasise that computer-based practice activities provide opportunities for differentiation, individualisation, intensification, and self-regulation (2010, p. 216).

Suszczyńska (2014) states that today's media tools can effectively support foreign language teaching thanks to their multimedia features. She also adds that today's young people belong to an era dominated by visual and auditory achievements and want to use these in their lessons.

Another topic of the study is grammar teaching. Along with other language skills, grammar is also an important part of language learning and affects the learning process. Grammar teaching has always been a topic of debate and remains a controversial issue in today's digital age. Although the role of grammar in foreign language teaching is a controversial topic, grammar, like other language skills, is one of the building blocks of foreign language teaching. Huneke and Steinig also emphasise that foreign language teaching is unthinkable without grammar (2010, p. 176).

In the mid-1990s, Christoph Zähner (as cited in Müller, 2020, p. 6) emphasised the need for comprehensive research into the role of computers in language learning in order to develop meaningful learning programmes. Patricia Manning's research shows that computer programmes have a positive effect on learning grammar rules because they encourage learners' motivation and autonomy. Sagarra and Zapata (cited in Müller, 2020, p. 6) also examined the relationship between the use of digital workbooks and students' (study) attitudes. Although the studies yielded both positive and negative results, it was found that grammar knowledge improved significantly.

Another important factor in successful learning is 'motivation'. 'Motivation' plays a major role in effective learning. It is believed that things that are learned with pleasure can be learned easily (Huneke & Steinig, 2010, pp. 19-20). In this context, the use of digital media in lessons is of great importance because it can have a positive effect on the learning motivation of today's Generation Z, known as the digital generation (Lambova and Vassileva, 2017, p. 4).

Population and Sample

The population of the study consists of preparatory classes at the Turkish-German University, while the sample comprises preparatory classes that voluntarily participated in the study.

Method

The research includes pre- and post-tests with students, lesson observations, interviews, and digital tasks related to grammar topics at the "A" level of the Common European Framework of Reference for Languages.

The "triangulation method", widely used in social sciences, educational research, and measurement and evaluation, was employed in this thesis. The triangulation method involves considering multiple data sources obtained at different times (Denzin, 1970, cited in Aguado, 2014, p. 49) and is an approach that uses multiple data sources, methods, or theories to understand a phenomenon more reliably and validly. One of the most important functions of the triangulation method is "verifying the validity of existing data and/or results," while another is "systematically expanding the possibilities for acquiring knowledge and drawing conclusions" (Aguado and Riemer 2001, cited in Aguado, 2014, p. 50). In this study, the reliability of the findings obtained by using different data collection and analysis methods

together has been increased, and the accuracy of the results has been meticulously verified using various methods.

In the first stage of the data collection process, a 40-question pre-test was administered, designed according to a 3-point Likert scale to measure students' grammar skills and perceptions regarding the impact of digital applications. This was followed by the "Netzwerk Neu" A1 level "Personal Pronouns, Possessive Pronouns, Statement & Question Sentences, Verbs, Auxiliary Verbs, Present Tense Conjugation, Definiteness, Nouns, Noun Cases, Prepositions, Imperative Mood, Adjectives, Negative Words, Sentence Elements, Past Tense (Perfekt & Präteritum), 0th Position Conjunctions (ADUSO-Konnektoren) at A2 level, and "Conjunctions (deshalb, trotzdem), Subordinate Clauses (weil, dass, ob, als, wenn-Sätze), Cases of Nouns, Adjective Conjugation, Gradation of Adjectives, Reflexive Verbs, Past Tense (Perfekt & Präteritum), Subjunctive Mood, Verbs (werden), Indirect Question Sentences, Prepositions, Verbs (Dative & Accusative), Prepositional Verbs, Relative Clauses" grammar topics were covered during the lessons using 250 computer-based materials.

The activities were prepared using the "Wordwall" and "LearningApps" platforms. The reasons for choosing both platforms include free use, multilingual support, ease of use thanks to a simple interface, the ability to create interactive and fun exercises, the ability to send individual study links to students, the ability to add audio, visual and video content to activities, and the provision of printable content. These designs aimed to increase the frequency of exercises for students and enable them to learn the rules at their own pace.

The implementation process lasted 14 weeks, culminating in a final test consisting of 46 questions, six of which were open-ended, and a question-and-answer interview, during which qualitative data was collected. In the interview, students were asked five questions about the contribution of computer-assisted exercises to their grammar learning, the effect on their motivation, their positive and negative experiences during use, and a comparison of traditional and digital resources. In addition to these research methods, students were observed throughout the process.

Before starting the research, the necessary permissions were obtained from the Scientific Research and Publication Ethics Committee of the Turkish-German University, and the research was conducted with the permission and approval of the School of Foreign Languages, to which the preparatory classes are affiliated. At all stages of the research, participants were informed about the scope and purpose of the study, and their consent to participate in the research and the processing of their data was obtained verbally and in writing. To protect the confidentiality of the participants, their identities have been anonymised in the statements used in the research.

Findings

The collected data were analysed using SPSS software and Excel. Before selecting the appropriate analysis methods, the results of the participants in the two areas of the questionnaire – perception of grammar and perception of the use of applications in grammar learning – were analysed to determine whether the difference values between the pre-test and post-test followed a normal distribution. The results of the Shapiro-Wilk test are shown in Table 1.

Table 1.

Shapiro-Wilk Normal Distribution Test Results

	Statistic	*df*	*p*
Grammar Perception	.906	20	.053
Perception of Application Use in Grammar Learning	.881	20	.018

The results of the Shapiro-Wilk test indicate that grammar perception values are normally distributed and therefore require the use of a parametric test. On the other hand, perception values regarding the use of applications in grammar learning do not show a normal distribution, necessitating the use of non-parametric tests to compare pre- and post-test results.

Therefore, a paired samples t-test was used to analyse the differences in grammar perceptions between the pre-test and post-test. The mean difference in perceptions regarding the use of digital tools in grammar learning was analysed using the Wilcoxon signed-rank test, the non-parametric equivalent of the paired samples t-test.

The results of the paired samples t-test are shown in Table 2.

Table 2.

Paired-Sample T-Test Results for Grammar Perception

		N	Mean	Std. Deviation	*t*	*df*	*p*
Grammar Perception	Pre-test	20	2.56	.181	1.291	19	.212
	Final test	20	2.49	.199			

Participants' scores in the first section of the questionnaire were compared using a matched-sample t-test between the pre-test and post-test. The mean values in the pre-test (M = 2.56, SD = 0.181) were found to be not significantly different from those in the post-test (M = 2.49, SD = 0.199), t(19) = 1.291, p > 0.05.

This indicates that participants' perceptions of grammar were not affected by the lessons and remained static.

The comparison of the values in the second part of the questionnaire – that is, perceptions regarding the use of applications while learning and applying grammar – was performed using the Wilcoxon signed-rank test. The results are shown in Table 3.

Table 3.

Results of the Wilcoxon Signed-Rank Test Regarding Perceptions of Application Use in Grammar Learning

		N	Mean	Median	Std. Deviation	*Z*	*p*
Perception of Application Use in Grammar Learning	Pre-test	20	2.55	2.56	.213	-2.473	.013
	Post-test	20	2.69	2.68	.134		

When examining the results of the comparison between participants' pre-test and post-test scores in the application perception domain more closely, it is observed that the post-test values (Mdn = 2.68) are significantly higher than the pre-test values (Mdn = 2.56), with a large effect size of Z = -2.473, p < 0.05, r = 0.55.

In particular, an increase was observed in the post-test scores of 80% of the participants, which contributed to the increase in the median value observed from the pre-test to the post-test.

Qualitative findings indicate that students stated that digital environments immediately highlight errors and make learning more enjoyable and motivating. Some students mentioned that the repeatability of exercises in the digital environment positively affected the learning process.

In the interviews, students stated that digital environments immediately highlighted errors and made learning more enjoyable:

Female Student 1: "Working from a book is boring; constructing sentences in a digital environment is more enjoyable and productive!"

Female Student 2: “The book covers general topics, but in the digital environment, I can notice the details.”

Male Student 2: “I realised I learned when I did it myself.”

Male Student 3: "When I compared myself to my friends in other classes, I realised that while they were memorising sentences, I understood the logic of sentence construction and could form my own sentences. I think the reason for this is that we solved a lot of questions and learned the exceptions."

Some compared traditional methods with digital exercises:

Male Student 1: "I also like learning by writing, so I want to work with the book occasionally, but once I've solved and finished the questions in the book, I don't want to look at the book again. But digitally, I can start from the beginning and repeat, and that helps me learn."

Male Student 12: "Madam, I tried to solve it from the book, but I didn't understand it. Let's do it together!"

Discussion, Conclusions, and Recommendations

Discussion:

The findings of this research show that computer-assisted grammar teaching makes significant and concrete contributions to the learning processes of preparatory class students. The fact that students can immediately identify their mistakes while working on digital exercises, the flexibility to repeat activities, and the opportunity to progress at their own pace directly aligns with Huneke & Steinig's (2010) view that digital and interactive learning environments provide individualisation, concentration, and self-regulation. Furthermore, students' perception of digital materials as both motivating and facilitating learning strongly parallels Steel's (2012) findings that mobile applications create continuity and engagement by bringing learning into everyday life. Within this framework, the study results show that computer-assisted exercises concretise abstract grammar structures, strengthen learner autonomy, and offer a pedagogical approach that is particularly compatible with the learning habits of the digital generation.

Results:

Overall, computer-assisted digital exercises make a meaningful contribution to the grammatical development of students learning German at university preparatory level. Working with feedback-oriented, repeatable, and interactive tasks increased students' learning motivation and enabled them to internalise grammatical rules more quickly and permanently. This is consistent with Huneke & Steinig (2010), who state that digital environments offer a structure that individualises learning and facilitates the student's management of their own learning process. Furthermore, the availability of digital exercises outside of class time has helped language learning extend beyond the classroom and naturally integrate into daily life, confirming Steel's (2012) findings that mobile learning supports continuity. In conclusion, the comprehensive integration of computer-assisted grammar teaching into the curriculum, supporting teachers in digital content production, and encouraging students to interact regularly with digital tools presents an important direction for future applications.

Recommendations:

Our study offers the following recommendations in the hope that it will provide useful insights to all individuals and institutions responsible for German grammar, which is a crucial part of German Language Education and Teaching:

1. **For School Administrations**

- ➢ Digital exercises can be integrated into the curriculum
- ➢ The blended learning model can be encouraged
- ➢ Teachers can be supported in producing digital content and encouraged to use it with teacher guidance

2. **For Educators**

- ➢ Teachers delivering grammar lessons can integrate various types of digital exercises into their lessons, tailored to visual, auditory, and kinesthetic learning styles, taking different learning styles into account.
- ➢ Interactive applications and gamification elements that allow students to actively participate can be used.

3. **For Digital Platform Developers**

- ➢ Artificial intelligence-supported applications can be developed.
- ➢ Mobile-friendly and accessible platforms can be promoted
- ➢ The effectiveness of digital exercises can be continuously monitored and improved
- ➢ Self-assessment and peer assessment tools can be added

These recommendations aim to transform grammar teaching from rote memorisation of rules to a learning model in which students actively participate in the production process.

Computer-assisted grammar teaching is no longer just an alternative method, but a necessity suited to the learning styles of the new generation.

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Generative Artificial Intelligence Statement: While ChatGPT was used for grammar checking during the preparation of the article, we guarantee that we are fully responsible for the accuracy and integrity of the content.

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Turkish Adaptation Study of the Meaning in Life in Children Questionnaire

Nurdan Kırgın[1] Seda Donat Bacıoğlu[2]

Abstract

The aim of this study is to adapt the Meaning in Life in Children Questionnaire (MIL-CQ), developed by Shoshani and Russo-Netzer (2017) and based on Victor Frankl's logotherapy theory, into Turkish and to examine its psychometric properties. The study group of the research consists of 320 students aged 9-12 attending primary and secondary schools in the province of Edirne during the 2024-2025 academic year. The MIL-CQ and the Stirling Children's Well-being Scale were used as data collection tools. Confirmatory Factor Analysis (CFA), Cronbach's Alpha, Pearson Correlation, and ANOVA tests were applied in the data analysis. CFA results show that the questionnaire's original three-factor structure (Creativity, Experiential, Attitudinal) has good fit values. However, results obtained from the Turkish sample revealed a unidimensional structure. The internal consistency coefficient (Cronbach's Alpha) of the questionnaire was found to be .83. Analyses revealed a strong and positive relationship between meaning in life and emotional and psychological well-being. Furthermore, it was determined that female students had higher meaning in life scores compared to male students, and students at lower grade levels (4th grade) had higher scores compared to students at upper grade levels. The study demonstrates that the MIL-CQ is a valid and reliable measurement tool for Turkish children.

Keywords: Meaning in Life, Positive Psychology, Child Psychology

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Introduction

Meaning in life is defined as the level of having a goal or an overarching life purpose that allows individuals to make sense of their lives (Steger, 2012). This concept has been discussed and researched in the psychology literature for a long time. The concept of "meaning" is also included in the PERMA model developed by Seligman, one of the pioneers of positive psychology. According to this model, the components that provide psychological well-being are Positive emotion, Engagement, Relationships, Meaning, and Accomplishment (Seligman, 2011). Within the framework of existential theory, meaning in life is also at a crucial point for a person's psychological well-being. Irvin D. Yalom (2018) states that individuals must confront their existential anxieties. These anxieties are death, meaninglessness, freedom, and isolation. The anxiety of meaninglessness can come to the fore in individuals along with the fear of death. However, this anxiety of meaninglessness is important for the person to make their life meaningful (Yalom, 2018). According to Carl Rogers (2024), the pioneer of humanistic psychotherapy, the process of self-actualization is a critical point in an individual's finding meaning in life. Viktor Frankl (1963), the pioneer of logotherapy theory, states that the fundamental motive of humans is the "search for meaning." Furthermore, he argues that a meaningful life is at the center of psychological health. Viktor Frankl states that individuals add meaning to their lives in three fundamental ways, termed the 'meaning triangle' in logotherapy theory. These three dimensions are experience, creativity, and attitude. These ways of finding meaning are valid not only for adults but also for children. Children also add meaning to their lives based on their experiences, what they produce through creativity, and their attitudes. With the experiential dimension, children find meaning in their lives through experiences with the environment, such as family, friends, school, or nature. With creativity, children find meaning through games, stories, art, or other activities they produce. In the attitudinal dimension, children find meaning in life through their perspectives and problem-solving skills in the face of a negative event or a challenging situation (Shoshani & Russo-Netzer, 2017; Frankl, 1963).

Purpose of the Study

The main purpose of this study is to adapt the Meaning in Life in Children Questionnaire (MIL-CQ), developed by Shoshani and Russo-Netzer (2017) based on the "meaning triangle" conceptual framework in Viktor Frankl's logotherapy theory, into Turkish and to examine the psychometric properties of the questionnaire. The research aims to contribute to the understanding of the construct of meaning in life in childhood. The study also aimed to determine whether the data obtained from the questionnaire differed according to demographic variables such as gender and grade level. Additionally, within the scope of the study, it was aimed to evaluate the relationships between children's levels of meaning in life and their emotional and psychological well-being and to reveal the nature of this relationship.

Significance of the Study

When the literature is examined, it is seen that the vast majority of scales and questionnaires developed to evaluate meaning in life focus on adolescent and adult samples, while valid and reliable measurement tools for children are quite limited (Demirdağ & Kalafat, 2015; Akın & Taş, 2015; Kahleoğulları, 2017). In this context, this study is important in terms of introducing a measurement tool to the literature that takes into account the developmental characteristics of children and whose validity has been ensured in the cultural context..

Literature Review

There is research in the literature indicating that there are many variables related to the concept of meaning in life and that there are relationships between these variables. In a study conducted on university students, a positive relationship was found between life goals and meaning in life (Demirbaş Çelik, 2016). A positive relationship was also found between meaning in life and psychological well-being. As meaning in life increases, there is an increase in individuals' psychological well-being (Karaçalı & Korkmaz, 2023). In another study, it was concluded that as meaning in life increased, self-esteem decreased, while hope and life satisfaction levels increased (Boz, 2022).

In addition to these studies revealing the relationship of meaning in life with different variables, it was observed that there are tools for measuring this concept. When the literature is examined, it is seen that Turkish tools aimed at measuring the phenomenon of meaning are mostly developed or adapted on adolescent and adult samples. The Meaning in Life Questionnaire (MLQ) developed by Steger, Frazier, Oishi, and Kaler (2006) was adapted into Turkish using a sample of university students, and its cultural adaptation was realized (Akın & Taş, 2015). Furthermore, while there are studies conducted on adolescent samples, studies on children are more limited. In a study conducted by Arslan and Tatar (2022), the psychometric properties of the Meaningful Life Measure were examined on a sample of adolescents, and it was revealed that the scale is a valid and reliable measurement tool. The findings obtained show that the scale is an effective tool in measuring the concepts of meaning in life and life purpose in adolescents. In another study, the Determination of Life Goals Scale for Children and Adolescents (DLGS-CA) was developed to measure meaning in life in adolescents, and it was determined to be a psychometrically valid and reliable tool. The study revealed that the scale is an effective tool for measuring life goals in adolescents aged 9-19 (Aldemir & Demir, 2022). The Life Goals Scale for Adolescents in the Context of Positive Psychotherapy (LGS-APP) by Eryılmaz (2010) measures adolescents' career, relationship, and sensation goals. Additionally, the Life Goals Scale for Adolescents study developed by Yentir Kanal (2019) was applied to students aged 14–18 and revealed that the scale is a reliable tool for measuring life goals in adolescents. İşmen Gazioğlu and Demirbaş Çelik (2015) examined the psychometric properties of the Meaning in Life Questionnaire (MLQ), previously developed by Steger, Frazier, Oishi, and Kaler (2006), on high school students. While all these studies offer some important tools on adolescent samples, they show that the number of scales specific to the child age group is quite limited, suggesting a need to fill this gap in the literature.

Method

Sample

The sample of the study consists of students aged 9-12 studying in primary and secondary schools in the Central district of Edirne province in the second term of the 2024-2025 academic year. The total sample consists of 320 students. The sample consists of 53.8% female (n = 172) and 46.3% male (n = 148) students. The distribution according to grade level is as follows: 4th grades 20.6%, 5th grades 23.4%, 6th grades 25.6%, and 7th grades 30.3%. This distribution shows a relatively balanced distribution among grade levels. Demographic information of the participants is presented in Table 1.

Table 1.

Descriptive Statistics Regarding Participants' Demographic Characteristics

Variable	Categories	Frequency	Percentage
Gender	Female	172	53.8
	Male	148	46.3
	Total	320	10.,0
Grade Level	4th Grade	66	20.6
	5th Grade	75	23.4
	6th Grade	82	25.6
	7th Grade	97	30.3
	Total	320	100.0

Procedure

The process of adapting the MIL-CQ into Turkish began after obtaining the necessary permissions from the owner of the questionnaire via email. In addition, necessary permissions were obtained from the Trakya University Ethics Committee and the Ministry of National Education. Then, the questionnaire was translated from English to Turkish by five people consisting of language and field experts, and back-translation was done by three people. The accuracy and intelligibility of the translations were tested with a pilot application conducted on 20 4th-grade students. At the end of this process, the questionnaire took its final form. Applications were carried out by the researcher in face-to-face groups, and data were collected from the students. Before the application, the purpose of the study was explained to the students. It was stated to the students that they could participate voluntarily and could leave if they did

not wish to continue. To ensure anonymity, no identifying information (ID number, school number, name, surname, etc.) was taken from the students. The data forms collected after the application were stored by the researcher and kept in a secure environment. They were used solely for scientific analysis purposes. Confirmatory factor analysis (CFA) was used for the construct validity of the questionnaire, and the correlation with the Stirling Children's Well-being Scale (SCWBS) was examined for convergent validity. The reliability of the questionnaire was examined with internal consistency. SPSS and JASP programs were used for validity and reliability analyses.

Data Collection Tools

In this study, the Meaning in Life in Children Questionnaire (MIL-CQ) and the Stirling Children's Well-being Scale (SCWBS) were used to collect data.

Meaning in Life in Children Questionnaire (MIL-CQ): Developed by Shoshani and Russo-Netzer (2017) on a sample of Israeli children. It is a 21-item questionnaire measuring meaning in life multidimensionally. The questionnaire was developed for children between the ages of 9-12. It consists of three sub-dimensions: Attitude, Creativity, and Experience. The distribution of items is as follows: items 1-6 represent Attitude, items 7-14 represent Creativity, and items 15-21 represent the Experience dimension. The Creativity dimension expresses children's skills in adding meaning to their lives through games, stories, art, and other productive activities. For example, the statement "I make things like songs, stories, games, etc., to contribute to others." (Item 7) reflects this dimension. The Experiential dimension covers children deriving meaning from family, friends, nature, and other environmental experiences. As an example, the item "I feel happiness and joy when I am with people close to me." (Item 18) can be given. Finally, the Attitudinal dimension represents resilience and positive perspectives exhibited in the face of difficulties and negative situations. An example of this dimension is the item "Although there are sad things in the world, I think life is worth living." (Item 3) . All items have a 5-point Likert-type response format (1 = Strongly Disagree, 5 = Strongly Agree). The total score range varies between 21 and 105, and high scores indicate a high perception of meaning in life. There are no reverse items. In the original study, the internal consistency coefficient (Cronbach's alpha) of the questionnaire was reported as .84 (Shoshani & Russo-Netzer, 2017).

Stirling Children's Well-being Scale (SCWBS): The Stirling Children's Well-being Scale (SCWBS) is a unidimensional measurement tool developed by Liddle and Carter (2015). The scale consists of 12 items and has a 5-point Likert-type (1 = Never, 5 = Always) rating. High scores indicate high levels of emotional and psychological well-being in children. There are no reverse items. The internal consistency coefficient (Cronbach's alpha) of the scale was reported as .85. The Turkish adaptation of the scale was carried out by Akın et al. (2016) on students in the 4-11th grade range.

Data Analysis

JASP and SPSS statistical programs were used in the analysis of the collected data. The construct validity of the questionnaire was examined with confirmatory factor analysis (CFA), and model fit indices (χ^2/df, RMSEA, SRMR, CFI, TLI, IFI, NFI) were evaluated (Hu & Bentler, 1999). The internal consistency of the questionnaire was calculated with Cronbach's Alpha and composite reliability (CR) coefficients (Hair et al., 2010). Additionally, Pearson correlation analysis was performed to examine the convergent validity between the measurement tools, and the relationships between sub-dimensions and total scores were also evaluated with this method. Differences according to gender and grade level were analyzed with the independent samples t-test and one-way ANOVA. When the distribution of the data was examined, it was determined that the skewness and kurtosis values were between -2 and +2, and therefore all variables showed a normal distribution (George & Mallery, 2001; Leech et al., 2005).

Limitations

- The data in the study were obtained only from students in the Central District of Edirne Province.
- Data were collected only from schools determined by the Ministry of National Education with ethical permission. The determined schools have similar profiles. Schools with different socioeconomic statuses and different educational practices were not included in the study.
- The data are based on children's self-reports..
- The study is a cross-sectional study.

Findings

Confirmatory Factor Analysis (CFA)

Çokluk, Şekercioğlu, and Büyüköztürk (2016) define CFA as a method that tests the verifiability of a predetermined limited structure within the framework of a model. In this context, the 21-item and 3-factor structure of the Meaning in Life in Children Questionnaire was tested with confirmatory factor analysis (CFA) using the JASP program. The structural equation regarding the model is presented in Figure 1.

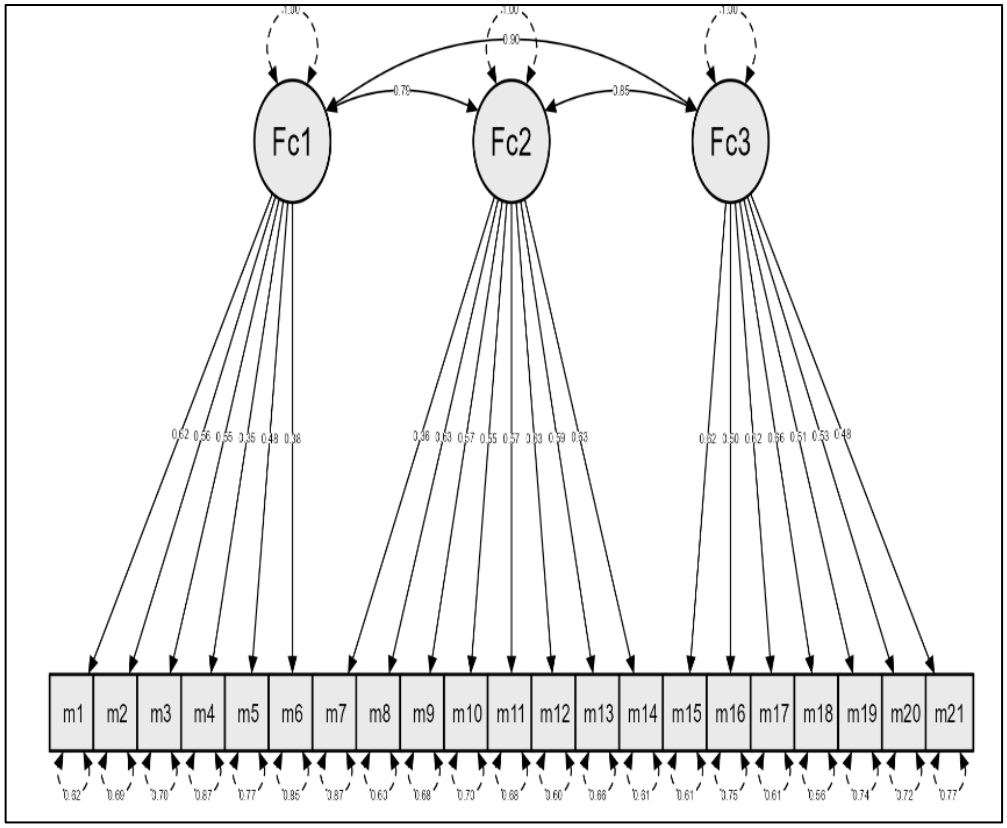


Figure 1. *Factor Model of the Meaning in Life in Children Questionnaire*

The fit values of the model obtained from the confirmatory factor analysis (CFA) regarding the 3-dimensional and 21-item structure of the Meaning in Life in Children Questionnaire were evaluated within the limits suggested by Hu and Bentler (1999). The chi-square and degrees of freedom values yielded a ratio of $X^2/df = 1.47$ and an RMSEA of 0.039, both indicating excellent fit. The SRMR value of 0.064 is at an acceptable level. When the other indices are examined, NFI = 0.942 indicates acceptable fit, whereas NNFI/TLI = 0,978, CFI = 0.980, and IFI = 0.980 indicate excellent fit. These indices demonstrate that the model shows a high level of fit and establishes a strong relationship with the data. In line with these findings, it is seen that the questionnaire structure is also supported in the structural model tested with confirmatory factor analysis. The fit indices of the model are presented in Table 2.

Table 2.

Model Fit Indices

Fit Index	Excellent Fit	Acceptable Fit	Model Values
X^2/sd	$0 \leq X^2/sd \leq 4$	$0 \leq X^2/sd \leq 5$	275.223/186 = 1.47

RMSEA	0 ≤ RMSEA ≤ 0.05	0.05 <RMSEA ≤ 0.08	0.039
SRMR	0 ≤ SRMR ≤0.05	0.05 <SRMR ≤ 0.10	0.064
NFI	0.95 ≤ NFI ≤ 1.00	0.90 ≤ NFI <0.95	0.942
NNFI (TLI)	0.97 ≤ NNFI ≤ 1.00	0.90 ≤ NNFI <0.95	0.978
CFI	0.95 ≤ CFI ≤ 1.00	0.90 ≤ CFI <0.95	0.980
IFI	0.95 ≤ IFI ≤ 1.00	0.90 ≤ IFI <0.95	0.980

When the item/factor loadings were examined, it was observed that all item loadings ranged between .355 and .664. Büyüköztürk (2007) states that item–total correlations of .30 and above indicate that the items distinguish individuals at an adequate level, and that factor loadings of .45 and above can be considered an appropriate criterion for item selection. These values show that the items represent their respective factors at a meaningful and sufficient level. All factor loadings are positive and significant. While the low standard error values support the reliability of the estimates, the Z (CR) values ranging between 12.307 and 23.728, all significant at the $p < .001$ level, indicate that the items make a strong contribution to the model. These findings demonstrate that the structural validity and reliability of the questionnaire are high. The regression weights and significance levels obtained from the CFA are presented in Table 3.

Table 3.
Factor Loadings and t Values from the Confirmatory Factor Analysis (CFA) of the Questionnaire

Factor	Item	Unstandardized Loading (β	Standard Error (SE)	Z (t-value)	Standardized Loading (λ)	p
Attitudinal	m1	618	31	19.951	618	<.001
	m2	560	29	19.059	560	<.001
	m3	552	30	18.582	552	<.001
	m4	355	29	12.307	355	<.001
	m5	478	28	16.841	478	<.001
	m6	385	28	13.779	385	<.001
Creativity	m7	358	27	13.294	358	<.001
	m8	634	28	22.290	634	<.001
	m9	567	24	23.298	567	<.001
	m10	550	26	21.252	550	<.001
	m11	568	26	21.570	568	<.001
	m12	633	27	23.728	633	<.001
	m13	587	27	21.670	587	<.001
	m14	628	27	22.896	628	<.001
Experience	m15	624	31	20.444	624	<.001
	m16	501	28	17.926	501	<.001
	m17	622	28	22.216	622	<.001
	m18	664	30	21.989	664	<.001
	m19	506	29	17.563	506	<.001

m20	529	33	16.110	529	<.001
m21	485	28	17.188	485	<.001

When the correlations between the factors were examined, quite high relationships were observed: 0.794 between Attitudinal and Creativity, 0.904 between Attitudinal and Experience, and 0.850 between Creativity and Experience. CR (Composite Reliability) was preferred to assess the reliability of the questionnaire's factors. For convergent and discriminant validity, AVE (Average Variance Extracted) values were calculated. In the literature, it is recommended that for convergent validity, AVE > 0.50, CR > 0.70, and CR > AVE (Gürbüz, 2019). According to the Fornell and Larcker (1981) criterion, the √AVE values of the factors (0.501; 0.572; 0.566) are expected to be higher than the corresponding correlation coefficients. However, the results obtained did not meet these conditions. Therefore, it was determined that discriminant validity could not be established (Gürbüz & Şahin, 2018; Büyüköztürk, 2019). The correlations and values between the subdimensions are presented in Table 4.

Table 4.
AVE and CR Values of the Factors and Inter-Factor Correlations

Factors	AVE	CR	√AVE	1	2	3
1. Attitudinal	0.251	0.659	0.501	1		
2. Creativity	0.327	0.792	0.572	0.794	1	
3.Experience	0.32	0.764	0.566	0.904	0.85	1

Construct Validity

To determine construct validity, a Pearson correlation analysis was conducted between the Meaning in Life in Children Questionnaire (MIL-CQ) and the Stirling Children's Emotional and Psychological Well-Being Scale (SCDPWB). The results indicated a strong, positive, and significant relationship between the total scores of MIL-CQ and SCDPWB ($r = .755$, $p < .01$). Additionally, regarding the subdimensions, moderate, positive, and significant correlations were found between Attitudinal ($r = .60$, $p < .01$), Creativity ($r = .64$, $p < .01$), and Experience ($r = .65$, $p < .01$) and the emotional and psychological well-being scores. These findings provide evidence for the construct validity of the questionnaire. The correlation coefficients obtained from this analysis are presented in Table 5.

Table 5.
Results of the Correlation Analysis Between Variables

Variables	1	2	3	4	5
1. Attitudinal	1				
2. Creativity	-	1			
3. Experience	-	-	1		
4. Meaning in Life (Total)	.80**	.86**	.84**	1	
5. Emotional and Psychological Well-Being	.60**	.64**	.65**	.755**	1

***p<.01*

Additionally, as an indicator of the structural consistency of the questionnaire, high, positive, and significant correlations were found, as expected, between the total Meaning in Life score and its sub-dimensions, Attitude ($r = .80$), Creativity ($r = .86$), and Experience ($r = .84$) ($p < .01$).

Reliability

A reliability analysis was conducted to determine the internal consistency of the questionnaire. The Cronbach's alpha coefficient for the total scale was calculated as $\alpha = 0.83$. For the subdimensions, the values were $\alpha = 0.60$ for the Attitudinal dimension, $\alpha = 0.69$ for the Creativity dimension, and $\alpha = 0.66$ for the Experience dimension. According to the literature, values of 0.70 and above are considered to

reflect high reliability and are generally deemed sufficient (Özdamar, 2013; Büyüköztürk, 2014). Accordingly, the reliability values of the subdimensions are close to an acceptable level, while the overall reliability coefficient of the questionnaire is high.

Descriptive Statistics of the Variables

Examination of the scores obtained from the Meaning in Life in Children Questionnaire (MIL-CQ) indicated that students' scores ranged from 39 to 105, with a mean of 83.58. The minimum possible score on the questionnaire is 21, and the maximum is 105. This finding suggests that participants generally obtained medium-to-high scores on the questionnaire. When examining scores by subdimensions, the highest mean was observed in the Creativity subdimension ($\bar{X} = 31.3$), and the lowest mean was in the Attitudinal subdimension ($\bar{X} = 21.89$). The mean score for the Experience subdimension was 30.4.

Regarding the Emotional and Psychological Well-Being variable, scores ranged from 14 to 60, with a group mean of $\bar{X} = 45.25$. This indicates that the sample group's emotional and psychological well-being levels are above the medium level. Detailed descriptive statistics for the variables examined in the study are presented in Table 6.

Table 6.
Descriptive Statistics of the Variables

Variables	Sub-Dimensions	N	Min.	Max.	M	SD
Meaning in Life	Attitude	320	9.00	30.00	21.89	04.08
	Creativity	320	14.00	45.00	31.37	5.13
	Experience	320	11.00	35.00	30.30	04.08
	Total	320	39.00	105.00	83.58	11.20
Emotional and Psychological Well-Being		320	14.00	60.00	45.25	8.87

Differences based on the gender variable were analyzed using an independent samples t-test. It was found that female students' total scores on the Meaning in Life Questionnaire (M = 84.75) were significantly higher than those of male students (M = 82.22; $t(318) = 2.02$, $p < .05$). At the subdimension level, no significant difference was found between female (M = 21.97) and male students (M = 21.81) for the Attitudinal subdimension ($p > .05$). However, in the Creativity subdimension, female students' mean score (M = 32.01) was significantly higher than that of male students (M = 30.64; $t(318) = 2.39$, $p < .05$). Similarly, in the Experience subdimension, female students' mean score (M = 30.76) was significantly higher than that of male students (M = 29.77; $t(318) = 2.18$, $p < .05$). These results are consistent with the findings of the original study (Shoshani & Russo-Netzer, 2017).

Regarding the Emotional and Psychological Well-Being scores, no statistically significant difference was found based on gender. The mean score of female students (M = 45.76) did not differ significantly from that of male students (M = 44.65; $t(318) = 1.16$, $p > .05$). All relevant descriptive and comparative statistics are presented in Table 7.

Table 7.
Independent Samples t-Test Results for Meaning in Life and Emotional–Psychological Well-Being Scores by Gender

Variables	Gender	N	M	SD	t	p
Attitude	Female	172	21.97	3.89	0.35	>.05
	Male	148	21.81	4.30		
Creativity	Female	172	32.01	4.96	2.39	<.05*
	Male	148	30.64	5.23		
Experience	Female	172	30.76	3.69	2.18	<.05*

	Male	148	29.77	4.45		
Meaning in Life Total	Female	172	84.75	10.55	02.02	<.05*
	Male	148	82.22	11.80		
Emotional and Psychological Well-Being	Female	172	45.76	7.85	1.16	>.05
	Male	148	44.65	9.16		

*p<.05

Descriptive statistics for the Meaning in Life and Emotional and Psychological Well-Being scores of the students according to their grade levels are presented in Table 8. Examination of the table shows that the mean scores for Meaning in Life are as follows: 4th grade, M = 88.72; 5th grade, M = 84.69; 6th grade, M = 82.71; and 7th grade, M = 79.93. The mean scores for Emotional and Psychological Well-Being are as follows: 5th grade, M = 46.62; 4th grade, M = 45.65; 6th grade, M = 43.90; and 7th grade, M = 43.01.

Table 8.

Descriptive Statistics of Variables According to Participants' Grade Level

Variables	Grade Level	N	M	SD
Meaning in Life	4th Grade	66	88.72	9.44
	5th Grade	75	84.69	11.21
	6th Grade	82	82.71	10.12
	7th Grade	97	79.93	11.82
	Total	320	83.58	11.20
Emotional and Psychological Well-Being	4th Grade	66	45.65	7.29
	5th Grade	75	46.62	8.19
	6th Grade	82	43.90	7.66
	7th Grade	97	43.01	9.27
	Total	320	45.25	8.48

A one-way analysis of variance (ANOVA) was conducted to determine whether students' Meaning in Life and Emotional and Psychological Well-Being scores differed according to grade level. The results indicated that grade level had a statistically significant effect on students' Meaning in Life scores ($F(3, 316) = 9.24$, $p < .001$). Similarly, a statistically significant difference was found between groups in terms of Emotional and Psychological Well-Being scores ($F(3, 316) = 7.57$, $p < .001$). The results of the analysis are presented in Table 9.

Table 9.

One-Way Analysis of Variance (ANOVA) Results for Meaning in Life and Emotional–Psychological Well-Being Scores by Grade Level

Variables	Source	SS	df	MS	F	p
Meaning in Life	Between Groups	3228.88	3	1076.29	9.24	< .001
	Within Groups	36803.01	316	116.47		
	Total	40031.89	319			
Emotional and	Between Groups	1541.26	3	513.75	7.57	< .001
Psychological Well-Being	Within Groups	21446.74	316	67.87		

Total	22988.00	319

*p<.001

To determine the source of the significant differences identified by the ANOVA, an LSD (post-hoc) test was conducted. Examination of the Meaning in Life scores revealed that 4th-grade students' mean score (M = 88.72) was significantly higher than those of 5th-grade (M = 84.69), 6th-grade (M = 82.71), and 7th-grade students (M = 79.93; $p < .05$). In addition, the mean score of 5th-grade students was significantly higher than that of 7th-grade students ($p < .05$). This finding indicates a decrease in Meaning in Life scores as grade level increases, with the highest scores observed in 4th grade.

Regarding Emotional and Psychological Well-Being, 4th-grade (M = 45.65) and 5th-grade students (M = 46.62) had significantly higher scores than both 6th-grade (M = 43.90) and 7th-grade students (M = 43.01; $p < .05$). No significant difference was found between 4th- and 5th-grade students ($p > .05$), nor between 6th- and 7th-grade students ($p > .05$). These results indicate that students in the early elementary grades (4th grade) and those transitioning to middle school (5th grade) exhibit higher levels of psychological well-being compared to students in the upper grades (6th and 7th grades).

Discussion, Conclusion, and Suggestions

The present study aimed to adapt the Meaning in Life in Children Questionnaire into Turkish and to examine the validity and reliability of its Turkish version. Examination of the confirmatory factor analysis (CFA) results for construct validity indicated that the model fit indices were at acceptable or excellent levels. The inter-factor correlation and AVE–CR analyses of this study suggest that the three-factor structure (Attitudinal, Creativity, and Experience) of the Meaning in Life in Children Questionnaire is not clearly differentiated within the Turkish cultural context. High correlations between the factors and the lack of discriminant validity indicate that Turkish children tend to perceive the meaning of life more holistically. This finding suggests that the concept of meaning in life is understood more integratively by children in Turkish culture. Therefore, it may be advisable to revise the questionnaire's current three-dimensional structure into a single-dimension or fewer dimensions. Such analyses could provide more culturally valid and reliable results. Future studies are recommended to apply the questionnaire to different age groups to further examine its dimensional structure, thereby enhancing the cultural adaptation of the instrument.

To test convergent validity, a Pearson correlation analysis was conducted with the Stirling Children's Emotional and Psychological Well-Being Scale. The analysis revealed a strong, positive, and significant relationship between the two instruments (r = .75), providing evidence for convergent validity. Reliability analyses indicated a Cronbach's alpha of .83 for the total scale, demonstrating high overall reliability. Although the internal consistency coefficients for the subdimensions were not at a high level, they were found to be close to an acceptable range.

Beyond the psychometric properties of the questionnaire, analyses of the study variables showed that female students had significantly higher total scores on Meaning in Life and higher scores on the Creativity and Experience subdimensions compared to male students. No gender-based differences were observed in Emotional and Psychological Well-Being scores. Regarding grade level, as students' grade increased, both Meaning in Life and Emotional and Psychological Well-Being scores decreased. The highest means were observed in 4th grade, and the lowest in 7th grade.

However, the study has several limitations. The sample was limited to children aged 9–12 (grades 4–7) living in the central district of Edirne, which restricts the generalizability of the findings. Additionally, the cross-sectional design prevents longitudinal inferences, and reliance solely on quantitative self-reported data may introduce social desirability bias. Future studies could include data from teachers and parents to complement children's self-reports. Qualitative data could also be collected to support the quantitative findings. Furthermore, data were collected only from schools permitted by the Ministry of National Education, which should be considered when generalizing results to the broader child population. Collecting data from schools with different profiles and locations in future studies could enhance the generalizability of the findings.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Data Availability Statement: The data obtained from this study are not publicly available due to confidentiality. Data can be requested from the authors via email for scientific purposes only. Requests must include a justification for the intended use.

Conflict of Interest: There is no conflict of interest among the authors of this study.

Generative Artificial Intelligence Statement: In this study, GEMINI and ChatGPT artificial intelligence applications were used to translate tables obtained from the SPSS program into English, format the relevant tables according to APA 7, and translate the text originally prepared in Turkish into English.

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Investigating the Behavioral Intentions of Preservice Science Teachers Towards Socioscientific Issue-Based Science Teaching

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Abstract

In recent years, science education researchers have emphasized the importance of socioscientific issues (SSI) as a way to engage students in inquiries and discussions related to their own experiences in both science and societal matters. In this context, it is important to create opportunities for preservice science teachers to design and implement SSI-based lesson plans and to evaluate these experiences. According to the theory of planned behavior, the likelihood that preservice teachers will engage in SSI-based science teaching in their professional careers depends on the components of personal attitude, subjective norm, and perceived behavioral control. This study aims to examine preservice science teachers' behavioral intentions toward SSI-based science teaching as a reflection of their experiences. In line with this aim, the research seeks to answer the question: "What are preservice science teachers' behavioral intentions toward SSI-based science teaching in their future professional lives?"

Twenty-one preservice teachers enrolled in the 8th semester of a science education program participated in this study, which was designed using the phenomenology design, one of the qualitative research methods. The participants were selected based on the criterion sampling method—one of the purposive sampling techniques—and on a voluntary basis. Within the scope of the interdisciplinary science teaching course, the instructional process related to socioscientific issues and their teaching consisted of three main stages: (1) building knowledge and awareness regarding SSI-based science teaching, (2) designing and implementing SSI-based lesson plans through microteaching, and (3) conducting evaluations. As a data collection tool, a structured interview form composed of open-ended questions was used. This form was developed by the researcher with support from the literature, aligned with the three main components that influence the likelihood of a behavior occurring according to the theory of planned behavior. The form was administered in written form at the end of the instructional practices. The collected data were analyzed using content analysis and quantified with the help of descriptive statistics. As a result of the study, it was determined that preservice teachers had positive behavioral attitudes toward SSI-based science teaching, possessed a high level of perceived behavioral control, and intended to implement this approach. Based on the findings of the research, it is recommended that teacher educators and science education researchers—who aim to investigate the impact of classroom practices—seek to understand preservice teachers' intentions to implement SSI-based science teaching in their future professional careers.

Keywords: behavioral intention, science teaching, preservice science teacher, socioscientific issues (SSI), theory of planned behavior (TPB).

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Introduction

One of the aims of science education is to cultivate a society composed of individuals who are interested in science, who consider science important for the real world, who can apply the knowledge and skills they learn about science to their own lives, and who can participate in conversations and discussions related to science within society (DeBoer, 2000). In this context, in recent years, science education researchers have increasingly emphasized the importance of socioscientific issues (SSI) as a meaningful way to support the development of students' scientific literacy and to engage them in inquiries and discussions related to their own experiences in both science and societal matters (Chen & Xiao, 2021; Eidin & Shwartz, 2023; Ke, Sadler, Zangori, & Friedrichsen, 2021; Kinslow, Sadler, & Nguyen, 2018; Zeidler, 2014).

Aligned with the goals of science education, teacher education plays a critical role in fostering a society composed of individuals who are sensitive to societal issues and capable of making informed decisions. In this regard, creating opportunities for preservice science teachers to design and implement SSI-based lesson plans before they begin their professional careers—and understanding or revealing their intentions to take action in this area as a reflection of these experiences—is of great importance.

Literature Review

Socioscientific Issues and Teacher Education

Topics that possess both social and scientific dimensions; are complex, controversial, and open-ended; have no single correct answer but multiple possible solutions; frequently appear in the media; include contrasting viewpoints that can be evaluated from multiple perspectives; require individuals to make personal and/or social decisions, engage in evidence-based and moral reasoning, and conduct risk analysis; involve applications in one or more fields (e.g., biology, sociology, ethics, politics, economics, environment); and may have regional, national, or global social and political implications are referred to as socioscientific issues (SSI) (Sadler, 2011; Topçu, 2015; Zeidler, 2014). Learning and teaching based on SSI represents a pedagogical approach that supports learners in understanding socially relevant scientific issues and in developing the knowledge, competencies, and skills necessary to apply these in solving problems within this context (Friedrichsen, Sadler, & Zangori, 2020). SSI-based science teaching is important not only for teaching fundamental science concepts but also for helping learners understand the relationships among interdisciplinary topics.

Schools are among the fundamental institutions through which a society's attitudes and behaviors can be influenced, and therefore curricula that focus on SSI hold significant importance (Arnold, 2018). In Turkey, one of the specific objectives of the science curriculum revised by the Ministry of National Education in 2018 is to "develop reasoning skills, scientific thinking habits, and decision-making abilities through the use of socioscientific issues" (MoNE, 2018). Achieving the goals targeted in the curriculum requires high-quality preservice science teacher education. However, the literature reports that both preservice and in-service teachers are often reluctant to implement SSI-based instrsouction for various reasons (e.g., lack of confidence in their pedagogical skills or SSI-related knowledge, difficulty in managing interdisciplinary collaboration, the time-consuming nature of SSI instruction, inconsistencies between SSI pedagogy and teachers' identities and beliefs, lack of materials and resources, etc.) (e.g., Chen & Xiao, 2021; Eidin & Shwartz, 2023; Hancock, Friedrichsen, Kinslow, & Sadler, 2019; Kinskey & Zeidler, 2021; Rydberg, Sjöström, & Olander, 2018). This reluctance may stem from the limited opportunities provided during preservice education for teachers to engage in instructional practices (Bennion & Davis, 2023).

For science teachers and preservice teachers to utilize effective pedagogical practices in SSI-based instruction, they need to understand why such instruction is important and how it can be taught effectively (Nation & Feldman, 2022). Preservice teachers' knowledge and experiences acquired during their training have a significant impact on their instructional practices in their future professional lives. One way to reveal preservice teachers' intentions to implement SSI-based science teaching in the future is to provide them with opportunities to plan and enact lessons during their preservice training. Preservice teachers perceive the instructional activities they participate in as a useful guide for lesson

planning, a criterion for self-evaluation, and a vision for the teaching and learning of science (Hanuscin & Zangori, 2016). To evaluate the effectiveness of classroom practices, teacher educators must understand preservice teachers' beliefs, which serve as indicators of their actions and behaviors (Bennion & Davis, 2023).

To understand preservice teachers' behavioral intentions or goals regarding how they will use their instructional experiences in their future professional lives, behavioral theories can be employed (Mills et al., 2023; Wijaya et al., 2022a), and the results can be used to improve teacher education programs. In this context, educators also utilize behavioral theories such as the Theory of Planned Behavior (TPB) to identify participants' behavioral intentions related to SSI (e.g., intentions to engage in SSI such as environmental issues) (Kirby, 2021; Summers & Abd-El-Khalick, 2018).

Theory of Planned Behavior (TPB)

The theoretical framework of this study is based on the Theory of Planned Behavior (TPB), developed by Ajzen (1985, 1988, 1991, 2012). TPB assumes that the likelihood of a behavior occurring in the future can be predicted by an individual's behavioral intention. According to TPB, behavioral intention refers to a person's readiness (preparedness) to perform a given behavior, and the stronger this intention is, the more likely the behavior will occur. Behavioral intention depends on three components: personal attitude toward the behavior, subjective norm (expectations), and perceived behavioral control over the behavior.

Personal attitude refers to an individual's positive or negative evaluation of a specific behavior, with a higher personal attitude indicating a greater tendency to respond positively toward that behavior. Subjective norms represent the social pressures (expectations) individuals perceive regarding whether they should or should not perform a behavior, as well as their motivation to comply with these expectations. Perceived behavioral control (PBC) refers to the perceived control over the performance of the behavior—how easy or difficult the behavior is perceived to be, and the extent to which individuals believe they can control the behavior.

As a general rule, the more positive the attitude and subjective norm are, and the greater the perceived control, the stronger an individual's intention to perform the behavior becomes. However, if individuals believe they have little or no control over performing a behavior due to inadequate or unfavorable conditions, their intention may be low even if their attitudes and subjective norms are positive. Behavioral intention and actual control are the factors that determine actual behavior. In other words, individuals are expected to carry out their intentions when sufficient actual control over a given behavior is present. Therefore, intention is assumed to be the direct antecedent of behavior (Ajzen, 1991; Ajzen, 2019; Ajzen, 2020; Ajzen & Kruglanski, 2019).

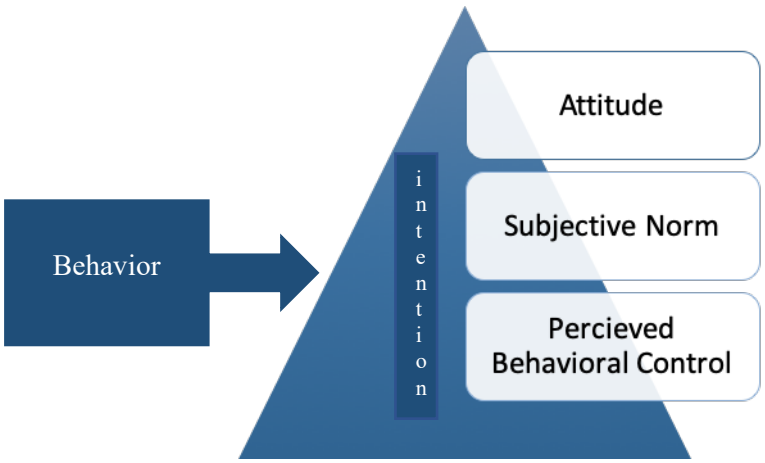


Figure 1. *Theory of Planned Behavior (TPB) (Zint, 2002)*

In this study, behavioral intention is defined as pre-service science teachers' intentions to implement SSI-based science teaching in their future professional lives. The Theory of Planned Behavior (TPB) is generally one of the most widely used theories for predicting the intention to perform a specific behavior, behavioral change, and for examining the factors that influence behaviors (Armitage & Conner, 2010; Fasching et al., 2025; Mills et al., 2023; Zhao et al., 2020; Wijaya et al., 2022a). According to the literature, in order to reveal or understand individuals' intentions to take action, "TPB has been successfully used to explain and predict behavior across numerous behavioral domains, ranging from physical activity to drug use, from recycling to travel mode choice, from safe sex to consumer behavior, and from technology adoption to privacy protection" (Ajzen, 2020, p. 314). However, studies utilizing TPB in the field of science education are limited, and among these few studies, the participants are mostly in-service teachers (Akilli & Aydogdu, 2019; Fasching et al., 2025; Heuckmann et al., 2020; Kılıç, 2012; Mentel et al., 2024; Opoku et al., 2021; Zhao et al., 2020). For example, Zhao et al. (2020) examined the factors influencing Chinese teachers' implementation of the DJP model as an innovative approach; Mills et al. (2023) investigated the intentions of pre-service elementary teachers to prioritize science teaching in their future practice; Wijaya et al. (2022a) explored the factors affecting Indonesian pre-service teachers' behavioral intentions to implement STEM education; and Fasching et al. (2025) analyzed Austrian physics teachers' intentions and willingness to teach climate action—a complex and controversial SSI—based on TPB, under the conditions that it is either a mandatory topic in the national curriculum or an optional subject. Based on their findings, Mills et al. (2023) emphasized the need for greater use of behavior and behavior-change theories in science education research. Studies specifically focusing on SSI-based instruction remain limited, and most have aimed solely to identify pre-service science teachers' profiles regarding their self-efficacy beliefs related to SSI-based teaching (Kara, 2012; Kılınç et al., 2013; Ozturk & Yilmaz-Tuzun, 2022). Therefore, this study aims to contribute to science teacher educators and science education researchers who seek to investigate the effects of classroom practices by providing insights into pre-service teachers' intentions to implement SSI-based science teaching in their future professional careers.

Aim and the Research Question

In this study, the aim is to examine pre-service science teachers' behavioral intentions to implement SSI-based science teaching in their future professional careers, as a reflection of their experiences in designing and implementing socioscientific issue (SSI)-based science instruction. In line with this aim, the following research question was addressed:

What are pre-service science teachers' behavioral intentions toward implementing SSI-based science teaching in their future professional careers?

Method

The study was designed according to the phenomenology (phenomenological) pattern, one of the qualitative research methodologies, and was conducted within the scope of the interdisciplinary science teaching course offered in the Science Education program at Faculties of Education in Türkiye. The implementation process of the topic "socioscientific issues and their instruction" within the interdisciplinary science teaching course consists of three main stages: (1) developing knowledge and awareness regarding SSI-based science teaching, (2) designing lesson plans for SSI-based science instruction and implementing them through micro-teaching, and (3) conducting evaluation.

Within the scope of the study, SSI-based learning activities were carried out in the Interdisciplinary Science Teaching course, and pre-service teachers prepared lesson plans for SSI-based science teaching in groups of 4–5 and implemented them in the classroom through micro-teaching.

Participants

The participants were selected using criterion sampling—one of the purposeful sampling methods—and on a voluntary basis. The criterion for selection was being a fourth-year pre-service science teacher enrolled in the "Interdisciplinary Science Teaching" course. The participants consisted of 21 pre-service science teachers in their eighth semester of study in the science education program of a public university located in the northwestern region of Türkiye. Their ages ranged from 21 to 24. Upon graduation, the participants will become middle school science teachers.

Data Collection Instrument

In the literature, a standardized TPB questionnaire is not provided, as the items used in existing questionnaires may not be suitable for a different behavior, population, or time frame. In addition to questionnaires, which are commonly used as quantitative measurement tools, open-ended response formats may also be employed to understand individuals' behavioral intentions (Ajzen, 2020). Several studies in the literature have examined participants' behavioral intentions toward a specific behavior through interview forms consisting of open-ended questions prepared within the framework of the TPB (Kılıç, 2012; Kılıç & Aydın, 2018; Zhao et al., 2020).

In the present study, the data collection instrument was a structured interview form composed of open-ended questions, prepared by the researcher in line with the three main components affecting the likelihood of a behavior occurring within the framework of the Theory of Planned Behavior. The form was developed by drawing on the relevant literature (Ajzen, 2002; Ajzen, 2019; Kılıç & Aydın, 2018; Mills, Whiteford, Brown, & Tomas, 2023; Özyıldırım & Durmaz, 2022). Expert opinion was obtained to ensure content validity of the interview questions. This form was administered in written form only as a post-test at the end of the instructional practices. The questions included in the interview form are presented in Table 1.

Table 1.

Interview Form

Component	Questions
Personal Attitude	1-a) When you are appointed as a teacher, do you intend to implement SSI-based science teaching in your classes? What is your personal attitude toward this? b) If your answer to the above is "yes," what would be your purposes/reasons for implementing SSI-based science teaching, or what benefits/contributions would such instruction have (for both teachers and students)?
Subjective Norm	2-a) When you are appointed as a teacher, do you think there may be expectations for you to implement SSI-based science teaching? If "yes," by whom or which institutions/organizations do you think these expectations would come? b) What is your view regarding fulfilling these expectations? Are you willing to meet them? Why?
Percieved Behavioral Control	3-a) When you are appointed as a teacher, what do you think about how easy or difficult it would be for you to implement SSI-based science teaching? What possible challenges might you encounter (from both teacher and student perspectives)? b) Do you believe you can overcome the challenges you may face? Please write your answer in detail.

Data Analysis

The collected data were analyzed using the qualitative content analysis method, employing both deductive thematic analysis (using pre-existing themes from the literature) and inductive thematic analysis (deriving themes from the data itself). The coding process and its outcomes were discussed and resolved collaboratively by the study's author and an independent researcher until a consensus was reached. Subsequently, the obtained qualitative data were quantified with the aid of descriptive statistics.

Findings

The data obtained to predict pre-service teachers' behavioral intentions to implement STEM-based science teaching in their professional lives are presented below according to the components of personal attitude toward the behavior, subjective norm (expectations regarding the behavior), and perceived behavioral control over the behavior. The qualitative data obtained from participants' responses to the interview form were quantified using frequency values indicating the occurrence of statements. Since participants could provide multiple responses to each question, the frequency value (f) may differ from the total number of participants.

Pre-service teachers' personal attitudes toward implementing STEM-based science teaching

Participants' attitudes toward STEM-based science teaching include behavioral beliefs regarding the benefits and contributions of this pedagogical approach. All 21 pre-service teachers stated that they intend to implement STEM-based science teaching when they are assigned as teachers in the future.

Their beliefs regarding the assumption that STEM-based science teaching can provide positive contributions for both students and teachers emerged under four main themes: skills, cognitive, affective, and pedagogical. Data describing participants' personal attitudes toward STEM-based science teaching and the associated behavioral beliefs are presented in Table 2.

Table 2.

Pre-service teachers' behavioral beliefs regarding the implementation of STEM-based science teaching

	I would consider implementing it because students…	
Theme	Code	f (Frequency of Statements)
Skill	Encourages research / develops research skills / fosters students as researchers	6
	Develops communication skills	6
	Develops inquiry skills	6
	Develops decision-making skills	5
	Develops critical thinking skills	4
	Develops discussion skills	3
	Develops problem-solving skills	3
	Develops analytical thinking skills	3
	Develops collaborative learning (teamwork) skills	3
	Develops socio-scientific inquiry skills	2
	Develops evidence-based decision-making skills	2
	Develops analysis skills	1
Cognitive	Develops multiple perspectives	7
	Relates knowledge to daily life	6
	Develops awareness of socio-scientific issues (SSI)	6
	Recognizes the connection between SSIs and science	3
	Enhances content (science) knowledge related to SSIs	2
	Understands the importance of reliable sources	2
	Follows the media	2
	Develops science literacy	1
	Develops technology literacy	1
	Relates knowledge to different disciplines	1
	Increases general culture	1
	Can generate different ideas	1
	Recognizes benefits/risks	1
Affective	Increases students' interest in the lesson	4
	Encourages students to express their ideas openly/freely	3
	Increases self-confidence	2
	Raises awareness (develops conscious citizens)	2
	Develops empathy	1
	Supports character development (more respectful/mature individuals)	1
Pedagogical	Ensures lasting learning	7
	Ensures meaningful/effective learning	4
	Facilitates easier learning	3
	Increases student participation in class	1

Table 2. (Cont.)

Pre-service teachers' behavioral beliefs regarding the implementation of STEM-based science teaching

	I would consider implementing it because teachers…	
Theme	Code	f (Frequency of Statements)
Pedagogical	Increases both the teacher's content knowledge and pedagogical knowledge / supports professional development and experience	6
	Ensures effective and lasting learning	2
	Improves classroom management skills	1
	Facilitates the development of students' higher-order thinking skills	1
	Enhances the teacher's guidance role	1
	Establishes effective teacher-student interactions	1
Cognitive	Increases awareness of socio-scientific issues (SSIs)	1
	Connects lessons to daily life and other disciplines	1
	Develops a holistic perspective	1
Affective	Provides teacher satisfaction and a sense of fulfillment from student achievements	3
	Encourages the teacher to use diverse teaching methods	1
	Makes lessons more engaging and enjoyable	1
	Strengthens trust between students and the teacher	1

According to Table 2, the participants believe that STEM-based science teaching can contribute to students' development in multiple ways. In terms of skills, it can enhance higher-order thinking skills such as research, inquiry, and decision-making and communication skills, which are considered 21st-century skills. Cognitively, it can raise students' awareness of socio-scientific issues (SSIs) and help them relate science to daily life and controversial societal topics. From a pedagogical perspective, it can promote lasting learning, while affectively, it can support students in expressing their ideas freely, building self-confidence, and developing empathy, among other social-emotional benefits.

From the teachers' perspective, participants assume that STEM-based science teaching can facilitate the creation of student-centered learning environments that are pedagogically effective, promote lasting and easier learning, and, affectively, provide satisfaction and happiness as a result of students' achievements. Cognitively, it is also expected to positively contribute to their own professional development.

Below are some direct quotes from the participants:

PsT6: *"I would like to implement it because it relates to social topics and issues that arise in our daily lives."*

PsT7: *"We should make students aware of discussions in daily life. I want to implement it to teach students that when making decisions on a topic, they should research, collect data, and evaluate the reliability of information sources rather than relying on hearsay."*

PST20: *"I would consider implementing it. I have a positive attitude toward this. I think every teacher should apply it in their classes without worrying about wasting time or causing classroom disruption."*

In light of these findings, it can be concluded that participants hold positive attitudes toward implementing STEM-based science teaching in their future professional lives.

Participants' Subjective Norms Regarding the Implementation of STEM-based Science Teaching

The data related to the subjective norm component, which reflects whether pre-service teachers perceive social pressure (expectations) from significant individuals, institutions, or organizations to implement STEM-based science teaching in their future professional lives, and their motivation to meet these expectations, are presented in Table 3. Since participants could indicate multiple individuals, institutions, or organizations, the total frequency count may differ from the total number of participants.

Table 3.

Pre-service Teachers' Perceptions of Subjective Norms Regarding the Implementation of STEM-based Science Teaching

Perceived Expectation	f	
No	4	
Yes	17	
	Source of Social Pressure (Expectations)	f (Frequency of Statements)
	Ministry of National Education (MEB)	6
	School principals	6
	Parents	5
	University instructors	4
	Colleagues / Department heads	3
	Curriculum developers	3
	Students	3
	Health-related institutions/organizations	3
	TÜBİTAK (in projects)	2

As shown in Table 3, while four participants indicated that they do not expect any external pressure, the vast majority (17) stated that there may be expectations for them to implement STEM-based science teaching in the future. These expectations are most likely to come from the Ministry of National Education (MEB) and school principals, as well as from parents, university instructors, colleagues, and students.

Among the four participants who believed there would be no expectations, two also expressed that they would not be willing to implement STEM-based science teaching in the future. Together with the two participants who thought there would be no expectations, a total of 19 participants indicated that they are willing to implement STEM-based science teaching in their future professional lives. According to Table 3, it can be inferred that the motivation of participants who expressed willingness is not driven by external expectations but rather by internal reasons.

PsT10: *"I am willing, not because there will be expectations. I will implement it so that students can become conscious citizens."*

PsT21: *"Not because there will be expectations. I will implement it; I am willing."*

PsT11: *"I am willing, but I also need to improve myself in this regard."*

PsT2: *"No (it should be voluntary), but I will implement it."*

Participants' normative beliefs regarding motivation to meet expectations emerged under four main themes: skills, cognitive, affective, and pedagogical. The obtained data are presented in Table 4.

Table 4.

Pre-service Teachers' Normative Beliefs Regarding the Implementation of STEM-based Science Teaching

	I am willing, because…	
Theme	Code	f (Frequency of Statements)
Skills	Develops communication skills	5
	Develops higher-order skills	1
	Develops inquiry skills	1
	Develops decision-making skills	1
	Develops socio-scientific inquiry (skepticism)	1
Cognitive	Develops science literacy	1

	Raises students' awareness about socio-scientific issues (SSIs)	1

Table 4. (Cont.)

Pre-service Teachers' Normative Beliefs Regarding the Implementation of STEM-based Science Teaching

	I am willing, because…	
Theme	Code	f (Frequency of Statements)
Affective	Supports students' success in life	1
	Enables students to express their ideas openly/freely	1
	Encourages respect for different opinions/people	1
	Provides significant positive contribution to personal development/character	2
	Develops conscious citizens (environmental awareness, voting awareness, health, etc.)	4
	I feel competent in this area	1
	To raise well-equipped individuals in all areas	1
	To raise individuals who research, inquire, and make informed decisions	1
Pedagogical	Increases student activity	3
	Ensures lasting learning	3
	Facilitates easier learning	1
	Ensures meaningful learning	2
Other	Offers many positive aspects/benefits/advantages for students	5
	Offers many positive aspects for teachers as well	1

Below are some direct quotes from the participants:

PsT4: *"I believe I can implement it, and I am willing to do so. STEM-based learning contributes positively by making students more active in class, promoting lasting learning, developing science literacy, enhancing higher-order thinking skills, and encouraging communication with peers."*

PsT8: *"I am willing to meet these expectations because I believe that individuals should express their ideas freely and respectfully. We sometimes encounter students who struggle to express themselves due to fear of being excluded or intimidated by peers at a young age. I think we can make a significant contribution to their personal development."*

Based on these data, it can be argued that pre-service teachers hold positive subjective normative beliefs regarding the implementation of STEM-based science teaching in their future professional lives.

Pre-service Teachers' Perceived Behavioral Control Regarding the Implementation of STEM-based Science Teaching

Perceived behavioral control refers to pre-service teachers' perceptions of how easy or difficult it will be to implement STEM-based science teaching in their future professional lives. All participants indicated that they expect these practices to be challenging. The potential sources of challenges that participants anticipate in implementing STEM-based science teaching were categorized into five themes based on the literature (Chen & Xiao, 2021): teacher-related, student-related, educational policy-related, school-related, and society-related.

The anticipated challenges in implementing STEM-based science teaching, as reported by the participants, are presented in Table 5. Pre-service teachers' beliefs about their ability to overcome the potential challenges they anticipate during the implementation of STEM-based science teaching reflect their control beliefs, which are generally considered as beliefs in their self-efficacy or personal capabilities. In response to the question, "Do you believe you can overcome these challenges?" two participants indicated that they do not believe they would be able to manage the difficulties. Below are examples of participants' responses:

PsT6: *"No, I don't believe I can. It requires too much time."*

PsT14: *"No, I don't believe I can. Especially in large classes, time may be an issue, and it may be difficult to develop higher-order thinking skills."*

Table 5.

Factors Perceived by Participants as Hindering the Implementation of STEM-based Science Teaching within the Perceived Behavioral Control Component

Theme (Source of Challenge)	Code	f (Frequency of Statements)
Teacher-related	Decreased classroom management/control / noise	9
	Creating a discussion-based environment	3
	Difficulty in lesson planning/design (details, interdisciplinary connections, time-consuming, data collection, etc.)	4
	Ensuring active student participation	2
	Remaining neutral as a teacher	1
	Teacher's lack of mastery of the SSI	2
	Teacher's inexperience	2
	Choosing appropriate SSI	1
	Insufficient pedagogical content knowledge	1
Student-related	Students' knowledge and skill level may be low	5
	Convincing students that SSIs have no single correct solution	3
	Especially in lower grades (students not sufficiently aware)	2
	Some students may act dominant/authoritative	2
	Students' misconceptions	1
	Students' social and cultural differences	1
	Students' attention may drift (process may take longer)	2
	Student resistance / reluctance	1
	Students may be unaccustomed to this approach	8
	Students may hesitate to express their ideas freely	6
	Peer bullying (by dominant/authoritative peers)	1
	Difficulty in developing empathy	1
Educational Policy-related	Requires more time (to cover curriculum / limited lesson time)	9
School-related	Large class sizes	4
	Shortage of materials/resources	1
Society-related	Parents completing out-of-class assignments (e.g., research)	1

19 participants indicated that they believe they would be able to overcome the potential challenges they anticipate in the future. Based on the literature (Chen & Xiao, 2021), participants' perceived beliefs about how they could manage these anticipated challenges were categorized into six themes: integrating SSIs into curriculum standards, designing productive learning activities, developing instructional materials and resources, creating a safe classroom environment, pursuing professional development, and collaborating with colleagues. The data obtained from the analysis of participants' responses regarding the perceived control beliefs component are presented in Table 6.

Table 6.

Pre-service Teachers' Perceived Control Beliefs Regarding Their Ability to Overcome Anticipated Challenges within the Control Beliefs Component

	I Believe I Can Overcome the Challenges (19 Participants)	
Theme	Code	f (Frequency of Statements)
Creating a Safe Classroom Environment	Preventing discussion-based activities from turning into chaos / avoiding disrespect or disorder	4
	Valuing freedom of thought	3

Professional Development / Experience	Having sufficient content knowledge	3
	Mastery of SSIs	1
	Through time / experience	3
	Good planning / integrating SSIs into curriculum standards	7
Colleague Collaboration	Seeking help from colleagues	1

Based on the obtained data, although the majority of participants believed that STEM-based science teaching could be challenging, they also believed that they could manage these potential difficulties by creating a safe classroom environment, advancing their professional development, and seeking support from colleagues. Some examples of participants' statements are presented below:

PsT4: *"I believe I can overcome the challenges I will face. … We may struggle to complete the curriculum set by the Ministry of Education. Implementing it in large classes, ensuring every student contributes, and creating a discussion environment may be difficult, but it develops students' higher-order thinking skills and promotes lasting learning. Therefore, I think these challenges can be overcome with proper planning."*

PST7: *"I think it will be difficult because students are generally not used to this type of method. When they encounter a different approach, they may struggle to understand and apply it, which will naturally challenge me as well. I believe I can overcome it … Even if we face difficulties initially, I believe that through experience I can successfully navigate this process with my students."*

Discussion, Conclusion, and Suggestions

This study assumes that pre-service teachers' responses to the interview questions, based on the experiences they gained in the interdisciplinary science teaching course, reflect their behavioral intentions toward implementing STEM-based science teaching as future science teachers. The research results revealed that pre-service teachers held positive behavioral attitudes and subjective norms toward STEM-based science teaching and had perceived behavioral control beliefs regarding their ability to overcome potential challenges. Based on these findings, it can be concluded that participants have behavioral intentions to implement STEM-based science teaching in their future professional lives. The following discussion is organized according to each component that determines behavioral intention.

Pre-service Teachers' Personal Attitudes toward Implementing STEM-based Science Teaching

According to the findings presented in Table 2, pre-service teachers believe that STEM-based science teaching will produce positive outcomes for both students and teachers in the skill, cognitive, affective, and pedagogical domains. In the skill domain, participants believed that STEM-based science teaching could enhance students' higher-order thinking skills, such as research, communication, inquiry, decision-making, critical thinking, analytical thinking, problem-solving, and collaborative learning.

For the cognitive domain, participants emphasized students' ability to recognize the connection between science and daily life and between socio-scientific issues (SSIs) and science, to raise awareness of SSIs, to understand the characteristics of SSIs (e.g., interdisciplinary connections, risk-benefit analysis), and to develop science content knowledge, science/technology/media literacy, and understanding of reliable information sources. Similar contributions were reported for teachers, as STEM-based teaching increases awareness of SSIs and helps them connect SSIs with daily life and other disciplines.

In the affective domain, participants believed that students' freedom of expression, self-confidence, and interest in lessons would increase, and their character development (empathy, respect for others and diverse opinions) would be supported. For teachers, benefits included satisfaction and happiness from students' achievements, motivation to use diverse teaching methods, and enhanced teacher-student trust.

Pedagogically, STEM-based science teaching was reported to promote lasting, meaningful, and easy learning for students and facilitate student-centered learning environments and effective teaching for teachers. These findings are consistent with the literature, which reports that STEM-based teaching enhances students' higher-order thinking skills, ethical and moral sensitivity, science literacy, and engagement with science in daily life (Borgerding & Dagistan, 2018; Kılınç et al., 2013; Nation & Feldman, 2022). Mills et al. (2023) also suggest that teachers' perceptions of including students in

learning and feeling satisfied/happy support positive affective interactions, which determine behavioral intentions. Zhao et al. (2020) found that teachers' positive attitudes toward innovative models were primarily based on observed positive changes in students, such as increased self-confidence and development of organizational and higher-order thinking skills.

As a learning community, schools shape students' beliefs about science, and these beliefs can be influenced by community members (Nation & Feldman, 2021). In this study, one participant noted that STEM-based science teaching could enhance teachers' guidance role, which is consistent with the literature emphasizing the importance of science teachers' guidance in nurturing critical-thinking scientific thinkers (Arslan & Durak, 2024).

Based on these findings, pre-service teachers have positive attitudes toward implementing STEM-based science teaching in their future professional lives. Similarly, Ualesi and Ward (2018) found that primary school teachers with positive life experiences and beliefs about the purpose of science teaching demonstrated positive feelings toward science teaching. Zhao et al. (2020) reported that teachers who focused on the advantages of a reformed teaching model had positive attitudes toward implementing it, while teachers concerned about disadvantages showed negative attitudes. Teachers' beliefs about the advantages and disadvantages of a model are linked to their evaluations of student learning outcomes and beliefs about effective teaching.

The literature suggests that microteaching and similar opportunities should be included in teacher education programs to foster enjoyment and familiarity with specific instructional approaches (Mills et al., 2023; Wijaya et al., 2022a). This exposure can positively influence pre-service teachers' behavioral intentions to implement STEM-based teaching. The present study also found that pre-service teachers hold positive beliefs about the beneficial outcomes of STEM-based science teaching for both students and teachers.

Pre-service Teachers' Subjective Norms toward Implementing STEM-based Science Teaching

Participants' beliefs about normative expectations (subjective norms) are presented in Tables 3 and 4. According to Table 3, the majority of participants indicated that external pressures might come from the Ministry of Education, school administrators, parents, university instructors, colleagues, students, TÜBİTAK, and health institutions. However, participants' motivation to meet these expectations appears to be primarily intrinsic. They identified multiple advantages of STEM-based teaching, such as fostering students' higher-order thinking skills, cognitive and affective development, and meaningful/lasting learning (see Table 4), demonstrating positive normative beliefs.

These findings align with the literature. Zhao et al. (2020) found that teachers expected expectations from administrators and students, but their motivation to meet these expectations depended on students' abilities, attitudes, and performance. Nation and Feldman (2022) reported that teachers feared "negative feedback" from stakeholders, and Fasching et al. (2025) similarly indicated that perceived social pressure from professional circles influences teachers' intentions and willingness to implement practices. Although this study did not analyze the degree of relationship between behavioral intention and subjective norms, the literature presents mixed findings regarding this relationship (Wijaya et al., 2022a, 2022b).

In this study, pre-service teachers most frequently emphasized affective contributions (conscious citizenship, personal/character development), followed by skills (students' communication and higher-order skills), pedagogy (lasting, meaningful, and easy learning), and cognition (science literacy), as motivating factors for their willingness to implement STEM-based teaching (see Table 4). Overall, participants were willing to meet potential expectations and were positively motivated to do so.

Perceived Behavioral Control over Implementing STEM-based Science Teaching

The findings suggest that pre-service teachers believe they can overcome challenges arising from teachers, students, educational policy, school, and society (see Tables 5 and 6). Participants identified student-related challenges most frequently, including students' unfamiliarity with the learning approach, hesitancy, dominant peers, and low knowledge or skill levels. Other student-related difficulties included resistance, misconceptions, social/cultural differences, and limited empathy (see Table 5). These

findings align with the literature, which identifies students' learning habits as the most significant teacher-related challenge in implementing SSI/STEM teaching (Arslan & Durak, 2024; Chen & Xiao, 2021; Nation & Feldman, 2022).

Teacher-related challenges included classroom management, lesson planning/design, ensuring student participation, inexperience, choosing appropriate SSIs, and insufficient content knowledge (see Table 5). These results are consistent with previous studies highlighting lack of content knowledge, pedagogical skills, insecurity, personal beliefs, and confidence in managing discussions as common barriers (Chen & Xiao, 2021; Kılınç et al., 2013; Nation & Feldman, 2022; Tidemand & Nielsen, 2017). One participant emphasized the need for teacher neutrality during classroom discussions, which the literature also identifies as challenging due to personal biases and beliefs (Arslan & Durak, 2024; Nation & Feldman, 2021, 2022; Tidemand & Nielsen, 2017).

Educational policy-related challenges included time constraints due to curriculum coverage and preparation of additional instructional materials (see Table 5). Literature confirms that limited time, dense curricula, and high-stakes assessments are significant barriers to SSI/STEM teaching (Chen & Xiao, 2021; Kara, 2021; Nation & Feldman, 2022; Zhao et al., 2020).

School-related challenges included large class sizes and insufficient materials/resources (see Table 5), consistent with previous studies citing lack of resources, negative school culture, administrative support, and financial constraints as obstacles (Chen & Xiao, 2021; Kara, 2012).

Society-related challenges involved parents completing out-of-class assignments, interfering with instructional activities (see Table 4), aligning with literature highlighting parental concerns as potential barriers (Chen & Xiao, 2021).

According to Table 6, pre-service teachers believe that they can manage these challenges by creating a safe classroom environment, advancing their professional development, and collaborating with colleagues. Literature supports the importance of a supportive, safe, and reliable classroom environment, well-designed learning activities, instructional materials, effective time management, and continuous professional development to overcome student-, school-, and policy-related challenges (Chen & Xiao, 2021).

Individual teacher beliefs can significantly impact the enactment of a behavior (here, implementing STEM-based science teaching) and ultimately student learning outcomes (Nation & Feldman, 2021). While participants expressed confidence in overcoming potential challenges, they may still require supportive school and classroom environments and additional resources to successfully implement STEM-based teaching. Behavioral intention alone may not predict actual behavior; adequate real-world control is necessary for pre-service teachers to carry out their intended practices.

Suggestions

Based on the findings, teacher educators and science education researchers are encouraged to explore classroom implementations to better understand pre-service teachers' intentions to implement STEM-based science teaching in their professional careers.

Limitations

One limitation of the study is the small number of participants. Another important limitation is the design and content of the interview form used for data collection. Therefore, it is recommended to use a combination of qualitative and quantitative methods to examine pre-service teachers' behavioral intentions and the factors influencing them more deeply.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Data Availability Statement: The data is not publicly available. The data can be made available upon request by contacting the author via email.

Conflict of Interest: There is no conflict of interest.

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Artificial Intelligence and Social Work: Applications, Challenges, and Prospects

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Abstract

This literature review provides an in-depth examination of the applications, challenges, and prospects of artificial intelligence (AI) in social work, drawing on recent scholarly publications from Greece, Turkey, and the international context. The review covers a wide range of technological applications, such as decision support systems for social workers, risk prediction algorithms (predictive analytics), natural language processing (NLP) tools for text analysis and categorization, and robotic interventions for supporting vulnerable groups. Through thematic categorization of the research, the advantages of AI in enhancing the effectiveness, accuracy, and personalization of social services are highlighted.

Particular emphasis is placed on the ethical and deontological challenges accompanying the introduction of such technologies. Issues such as transparency, privacy protection, avoidance of algorithmic bias, and the risk of reproducing social inequalities emerge as key concerns. The literature proposes specific models and frameworks, such as the EPIC model (Ethics, Participation, Integrity, Competence) and risk assessment methods, for the responsible and ethical integration of AI into social work practice.

At the same time, the non-negotiable significance of the human factor is underscored, as professional judgment, empathy, and interpersonal relationships cannot be fully replicated by machines. The need for continuous training of social workers, the development of interdisciplinary collaborations, and the establishment of clear institutional frameworks are identified as critical prerequisites for the successful application of AI in the field. In conclusion, AI can serve as a powerful tool for social work, provided it is applied responsibly and with respect for the values of the profession. The integration of AI into case management in social work shows significant potential for improving services, but it requires a strong institutional framework and ongoing training for professionals. Success depends on striking a balance between technological and

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Introduction

The utilization of AI systems in social protection agencies, from the automation of assessment processes to the use of chatbots for providing initial support, creates new possibilities but also significant ethical challenges (Madden et al., 2019). Machine learning systems, natural language processing, and predictive analytics offer valuable potential for improved decision-making, increased efficiency, and better resource utilization (Trewin, 2018). However, their application in the sensitive sphere of social work highlights significant issues concerning the protection of citizens' rights, the transparency of processes, and the preservation of the human dimension in social interventions (Reamer, 2018, 2023). The fundamental prioritization of needs following their assessment and their connection to available solutions constitutes an essential structural element of social workers' practice (Vindas, 2025).

Literature Review

Artificial intelligence is defined as "a system's ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation" (Kaplan & Haenlein, 2019, p. 15). Within the context of social work intervention, AI applications can include **Risk Assessment Systems:** Algorithms that assess the probability of child abuse or recidivism of delinquent behavior (Chouldechova et al., 2018). **Automated Application Processing:** Systems that process applications for social programs and determine eligibility (Henman & Marston, 2008). **Predictive Analytics:** Models that predict future needs and risks at a population level (Keddell, 2019). **Digital Assistants and Chatbots:** Systems that provide initial support and information to service users (Bickmore et al., 2018).

Deontological Framework of Social Work and Artificial Intelligence

Social work is based on a strong deontological framework that includes fundamental values such as: Human Dignity and equal participation in society, recognition of the unique value of every human being, social justice, promotion of equality and the fair distribution of resources in an organized society, equal rights and protection of human rights, integrity, honesty, transparency, and accountability in professional intervention, continuous development of professional skills (IFSW, 2018). These values form the basis for the interconnection with the offerings of artificial intelligence and the principles of social work (Tambe, Rice, 2018). For the analysis of the ethical dilemmas arising from the use of AI, this article focuses on three main ethical approaches: **Deontological Ethics (Kant):** Focuses on the inherent ethical value of actions, regardless of their consequences (Floridi et al., 2018). **Consequentialist Ethics (Mill):** Evaluates morality based on outcomes and the "greatest good for the greatest number" (Russell, 2019). **Ethics of Care (Gilligan):** Emphasizes relationships, compassion, and care as fundamental ethical values (Vallor, 2016).

Ethical Issues in the Use of AI in Social Work

Privacy Protection and Confidentiality

The protection of privacy is a fundamental principle of social work (NASW, 2021). AI systems focus on and utilize large quantities of personal data for their programming, creating significant risks for the privacy protection of service users (Zuboff, 2019, Coudannes et al, 2025). The main dilemmas concern the collection and processing of sensitive personal data without explicit consent, the retention of data beyond the initial purpose of collection, the risk of data breaches and unauthorized access, and the difficulty in ensuring anonymity in small communities. Susskind (2018) emphasizes that privacy protection is not merely a technical issue, but a fundamental human right that must be safeguarded in all phases of the design and implementation of AI systems.

Risk of AI Systems Adopting Bias and Discrimination

AI systems can reproduce and enhance existing social biases, leading to discriminatory treatment of vulnerable groups (O'Neil, 2016). In social work practice, this can have devastating consequences for individuals and families. Indicative examples can be mentioned, such as biased training data where historically used data reflecting past discriminatory practices are adopted (Barocas & Selbst, 2016), design biases such as the unconscious biases of developers that are embedded in algorithms (Noble, 2018), and data representativeness, i.e., the under-representation of certain groups in the programming

data (Buolamwini & Gebru, 2018). Research has shown that risk assessment systems in child protection display different rates of false positives among racial groups (Chouldechova, 2017), raising serious questions about justice and equality in the provision of social services. In other words, one can refer to the example of the Roma community and the rest of the community regarding the criteria of a deficient child support environment.

The principle of self-determination is a cornerstone of social work, recognizing the right of individuals to make decisions about their own lives (Dolgoff et al., 2012). The use of AI systems can restrict this autonomy in various ways. From this perspective, restrictions on autonomy in decision-making can be mentioned, i.e., systems that make decisions without human intervention (Pasquale, 2015). Additionally, a lack of transparency is noted. Reference can be made to algorithmic "black boxes" that do not allow understanding of the decision-making process (Burrell, 2016). Also, more generally, a framework of limited options is identified where standardized approaches do not take individualized circumstances into account (Eubanks, 2018). Gillingham (2019) argues that excessive reliance on automated systems can lead to "technological paternalism," where decisions are made for service users without their participation.

Professional Responsibility

The integration of AI into social work creates new challenges regarding professional responsibility and accountability (Taylor, 2017). Key questions can include issues of responsibility distribution. For example, who is responsible when an AI system makes the wrong decision, as well as issues of professional judgment freedom. That is, how professional judgment is maintained in an automated environment. Furthermore, the issue of continuous training can be mentioned, where the question arises as to what knowledge and skills social workers need to improve. Additionally, the issue of supervision and control exists. How is appropriate oversight of AI systems ensured? Reamer (2018) suggests that social workers must develop "technological literacy" to be able to effectively evaluate and supervise the use of AI in their practice. A digital divide into equality exists. The integration of AI into social services may exacerbate the digital divide, creating new forms of social exclusion (Robinson et al., 2015). Vulnerable groups who lack access to technology or do not possess the necessary digital skills may be excluded from essential services (Hodgson et al, 2022). Factors of digital exclusion can be related to economic constraints, or geographical constraints (rural – remote areas), age and reduced technological skills, language barriers, disability, and accessibility.

Deontological Challenges

The principle of informed consent from the service user becomes particularly complex within the context of AI (Winfield & Jirotka, 2018). It is necessary for service users to understand and participate in the decision-making process. Particularly important points are how their personal data will be used, how the systems that affect their lives operate, what their rights are regarding automated decisions, and how they can challenge decisions or generally disagree (Nuwasiima et al, 2021). Maintaining human oversight is a critical element for the ethical use of AI (Diakopoulos, 2016). This can include some minimal levels of human control: Human-in-the-loop, human intervention in every decision; Human-on-the-loop, human supervision and possibility of intervention; Human-out-of-the-loop, fully automated decisions (creates significant reservations for social work).

Discussion, Conclusion, and Suggestions

The integration of artificial intelligence into social work represents one of the most significant challenges and opportunities facing the profession in the 21st century. Although artificial intelligence offers potential for improved efficiency, accuracy, and accessibility of services, it simultaneously raises fundamental questions about the values, principles, and identity of social work. The main challenges lie in the areas of privacy protection, algorithmic bias, human autonomy, and professional responsibility. These challenges are not merely technical problems that can be solved with better algorithms, but fundamental ethical dilemmas that require careful thought and collective action. The proposed framework of deontological guidelines provides a basis for the ethical integration of technology, but its success depends on the active participation of all stakeholders: professionals, researchers, educational institutions, policy makers, and, crucially, the service users themselves. In this context, the ethical

dilemmas of AI are not static problems that can be solved once but evolving challenges that require continuous attention and adaptation. Also, service users must be participants in the design, implementation, and evaluation of systems and not merely passive recipients. For these reasons, collaboration between social workers, computer science specialists, and legal entities is a prerequisite. Technology needs to serve the values of social work, not the other way around. This means that some technological solutions may be rejected if they are not compatible with the fundamental principles of the profession. The future relationship between artificial intelligence and social work will be shaped by the decisions made on a systematic basis. If the professional community approaches AI with skepticism but also an open mind, if it invests in education and capacity development, and if it maintains human values at the center of technological solutions, then technology can become a powerful tool for promoting social justice and human well-being. Conversely, if it is adopted blindly, without sufficient consideration of its ethical implications, it risks undermining the fundamental values of social work and intensifying the social inequalities that the profession seeks to mitigate. After all, social work has a long history of adapting to social, technological, and political changes, while simultaneously maintaining commitment to the fundamental values of social justice and human dignity. The challenge of AI is no different from previous challenges, but it requires new skills, new knowledge, and new forms of collaboration. The future of social work in the age of AI will not be determined by technology but by the choices made by professionals, educators, researchers, and policy makers. If these choices are guided by the values of social work and the commitment to promoting human well-being, then AI can become an ally in the struggle for a more just and inclusive world.

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Online Peer Mentoring and Its Effects on University Students: A Review on Psychological Resilience, Social Belonging, and Academic Motivation

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Abstract

Mentoring is a process of social interaction involving the transmission of accumulated knowledge from an experienced individual to one who is less experienced. Peer mentoring programs are viewed as effective practices in promoting students' academic and socio-emotional development. It is fairly common for an undergraduate freshman to experience anxiety, stress, and adjustment struggles while undergoing the transition process to college because the years spent at university are when the students begin to deepen their identity development, along with having diverse expectations both academically and socially. Peer mentoring programs conducted in online environments, especially in recent years, have become one of the important support mechanisms aimed at helping students cope with these difficulties. This review study aims to examine mentoring models to understand the effects of online peer mentoring on university students. It investigated the effect of online peer mentoring programs on academic motivation, psychological resilience, and social belonging. The results recommend that programs of this kind should be perceived as not merely a stop-gap measure but rather, a sustainable support system within higher education. This study is likely to provide some theoretical insights to the literature on the concept of online peer mentoring.

Keywords: Mentoring, mentoring program, online peer mentoring

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Introduction

Young adults starting university face developmental characteristics such as identity search and uncertainties in social relationships, as well as academic expectations. This period, corresponding to the 18–29 age range, is a transition process in which the individual tries to adapt to new social and academic environments by becoming independent from their family (Arnett, 2000). Recent literature suggests that university students experience significantly greater levels of anxiety, depression, and stress symptoms than the general population (Auerbach et al., 2018; Grøtan et al., 2019; Awadalla et al., 2020). This impact makes it hard for students to adjust to university, ultimately affecting their self-efficacy perceptions and expectations for their future. A favourable view of the future is positively correlated with academic performance and well-being, whereas negative expectations correlate with low self-efficacy and high anxiety (Worrel & Mello, 2009). This structural nature of higher education and the ways students interact with one another place a spotlight on the peer mentoring relationships that can accompany these traits. Peer mentoring programs, in which experienced students guide newcomers, are widely used to facilitate adaptation to academic processes, provide psychosocial support, and help students take more confident steps into university life (Gehreke et al., 2024). It is stated that these relationships, conducted through group discussions, one-to-one meetings, or social support activities, strengthen social belonging by reducing anxiety, especially during the university adaptation period (Robinson Jr., 2025). With the pandemic period, the rapid integration of digital technologies into the field of education has also created a significant transformation in mentoring practices; many face-to-face programs have been moved to an online environment. Studies indicated that the online mentoring practices are beneficial not only for the academic advancement of students but also for their psychological resilience (Shashikala et al., 2022; Nzama, 2024).

This study aims to assess the outcomes of mentoring programs, focusing on the effects of online peer mentoring on academic motivation, psychological resilience and social sense of belonging among university students. This study will contribute to the development of the design and implementation of future mentoring programs. It will also contribute to a better understanding of the place of online peer mentoring practices in higher education by evaluating existing research as a whole. For this reason, the paper first state what mentoring is, which is fundamental approaches and mentoring models when defining mentoring; then discusses types of mentoring in need of the type of application. The paper then provides a review of the literature on the academic, psychological, and social effects of online peer mentoring among university students.

Method

This study was prepared using the review method to examine the literature on the concept of mentoring and peer mentoring models within a comprehensive framework. This literature review examined studies that investigated mentoring approaches, mentoring models, types of peer mentoring, and the influence of online peer mentoring on university students.

The search was performed in Google Scholar, ERIC, Web of Science, and Scopus databases using a combination of the following keywords and terms: "mentoring," "peer mentoring," "online peer mentoring," "developmental mentoring," "instrumental mentoring," "blended mentoring," "academic motivation," "resilience," and "sense of belonging." The selection of studies was based on the fundamental criteria of being directly related to the topic, examining university students, and presenting findings in the context of online peer mentoring.

The studies identified through the search were classified under thematic headings based on their content; the concept and approaches of mentoring, mentoring models, types of peer mentoring, and the academic, psychological, and social effects of online peer mentoring were analyzed under separate headings. This study aims to compile current information in the literature and present the relevant topics in a comparative and explanatory framework.

The Concept and Approaches of Mentoring

As students require more varied support academically and socially, new mentoring models have developed to fulfil different functions (Stigmar, 2016). Mentoring is defined as the support and guidance provided by a more experienced individual to a less experienced person in the process of achieving specific goals (Johnson & Lampley, 2010; Núnez et al., 2013). The often-sanctioned relationship is between those who have shared similar life experiences, resulting in a reciprocal learning and bonding experience (Koven 2024). In the literature on mentoring, mentor–mentee pairings are often framed in general as either developmental or instrumental/goal-oriented (Karcher & Nakkula, 2010).

Developmental Mentoring: An experienced adult/older pupil forms an ongoing, trust-constructed relationship with a younger individual, aimed to promote the social and additionally emotional improvement of the younger person. Under this approach, the relationship is formed through more informal and chance interactions (Karcher et al., 2006). Such unstructured programs lack formal guidelines, defined goals, or standardized session plans. The relationship between mentor and mentee develops within a more flexible framework tailored to personal needs. Allowing students to select their own mentors makes the process more personal. Still, without a formal structure, it does require a little more initiative from both sides to keep the program running. In this process, the mentor is expected to be attentive in understanding the student's needs and to use their own experiences as an effective guidance tool (Hernandez et al., 2017).

Instrumental Mentoring: In contrast to the developmental approach that is more fluid, instrumental mentoring takes a more structured approach that is very goal-oriented and focuses primarily on the transfer of skills and strategies. Mentor–mentee interactions in these programmes are often more structured with sessions, tasks, and defined outcomes (Schenk et al., 2020). Instrumental mentoring is conducted with defined guidelines, the frequency and content of meetings are clearer, the mentoring process is regularly monitored, and the roles of the parties are clarified at the outset. Such a structured framework alleviates uncertainty, especially for those students unfamiliar with the process, and provides an environment for safe learning (Halupa & Henry, 2015). Furthermore, formalizing communication in mentoring relationships helps mentors better understand students' challenges and makes the process more effective (Rees Lewis et al., 2018). It is noted that the instrumental approach is more effective, especially for individuals in high school and college. Youth (ages 12 to 18) are less interested in unstructured programs and gain more from structured skill-building programs (Hamilton & Hamilton, 2014).

The role of the instrumental approach in peer mentoring: Instrumental peer mentoring programs provide great opportunities for new university students. It targets not only social links but also the academic skills required to acquire their degree. One of the most common applications is tutoring programs, where upperclassmen provide academic support and aim to increase subject mastery (Stigmar, 2016).

Conversation-based interactions alone may often be insufficient in resolving the complex academic and personal challenges students face. Therefore, enriching mentoring processes with skill-building activities is of critical importance. Studies have found that when activities are made more intentional in the mentoring process, it markedly improves academic and social development (Karcher & Hansen, 2014). For example, Chester et al (2013) found that some mentoring practices in higher education are incorporated directly into course content while others, conducted as extracurricular activities such as counselling or orientation events, assist students' adjustment process (Sharp, 2021).

Mentoring Models

Mentorluk, bireylerin hem kişisel hem de akademik yaşamlarında gelişimlerine katkıda bulunan önemli bir süreçtir. This process can be examined under different models depending on its implementation. In the literature, mentoring practices are generally examined under one-to-one and group mentoring models. Both models can adapt to respond to specific needs but are different with respect to the experiences and impact areas they offer.

One-to-One Mentoring: The one-to-one form of mentoring helps to ensure a higher level of personal relationship between mentor and mentee. In this model, students can receive more direct and detailed feedback on both their academic and personal development. It is highly functional in terms of focusing

on specific goals and creating plans tailored to the student's needs. However, it presents some challenges in terms of sustainability in large-scale programs. However, one-to-one mentoring relationships can cost a lot, in time and human resources, to get right (Johnson et al., 2024). Hence, this model is most often used when it comes to a smaller group, chosen students, or cases that need special assistance.

Group Mentoring: A group in which a mentor is mentoring several students at the same time. This setup facilitates the formation of an interaction network between students and promotes peer learning amongst participants. Students who come together with a common goal both share knowledge and find themselves in a learning environment enriched by diverse perspectives (Jent & Niec, 2009). Group mentoring contributes to the learning of individuals and the establishment of social networks (Johnson et al., 2024; Barr et al., 2024). Having students with different experiences in the same environment both increases solidarity and helps students develop professional relationships. More specifically, structured peer groups can assist individuals through various phases of their career journeys. This can increase academic engagement while fostering a supportive culture (Barr et al., 2024).

Both mentoring models can be adapted to the needs of participants. One-to-one mentoring helps to tackle more personal and goal-directed problems, while group mentoring promotes the socialisation of students through similar experiences and forming collaborative learning environments. These models are interdependent in regard to supporting students' social-emotional and academic development, particularly in university (Turner et al., 2024). However, correctly implementing both models enhances student success, improves satisfaction with the educational process, and supports sustainable development (Johnson et al., 2024). To sum up, mentoring models are instrumental support systems for academic development and personal growth, as well as career guidance. A thorough understanding of the opportunities and limitations offered by one-to-one and group mentoring models will enable universities and institutions to design more effective mentoring programs (Barr et al., 2024).

Types of Peer Mentoring

The context within which peer mentoring programs take place can be very different, and therefore so can the structure of peer mentoring programs. These can be implemented face-to-face, online, or in a hybrid format. The choice of model depends on many factors, including the theoretical approach underlying the program, its intended outcomes (e.g., academic achievement, psychosocial support, career development), the identity of the mentor (alumnus or peer), whether the program is part of the curriculum, and the characteristics of the target audience (Andersen & West, 2020).

Face-to-Face Mentoring: In face-to-face mentoring the mentor and mentee are in the same physical environment. That kind of interaction is relatively strong when it comes to offering personal assistance. They provide great benefits in the development of student emotional awareness, communication, and social skills. The literature contains findings that the face-to-face mentoring process particularly enhances the quality of mentoring support (Gusar et al., 2024). As time passes, the relationship between the mentor and mentee can grow to allow for personal development and career development towards a more in-depth mentoring relationship (Prummer et al., 2024). Although this model has long been one of the most widely used methods, with the proliferation of digital tools today, most face-to-face programs are supported by email, messaging applications, or online meetings (Hernandez et al., 2017).

Online Mentoring: The growth in technology has made online mentoring programs more practical and allowed for a larger target audience. This model involves communication through email, messaging applications, video conference tools (e.g., Zoom, Skype, etc), or collaborative platforms like Google Docs. Online mentoring removes the geographical barrier with easy access to support, as the mentor and mentee may not even be in the same city, much less institution. This format eliminates location and time constraints, offering broader access to mentoring processes and enabling mentoring skills to reach wider audiences (Turner et al., 2024; Kuok et al., 2023). Furthermore, digital platforms enable the recording of information about the personal and professional characteristics of mentors and mentees, allowing for more compatible matches (Halupa & Henry, 2015). This increases the efficiency of the mentoring process. Online mentoring is particularly compatible with structures aimed at developing specific skills or supporting professional identity (Turner et al., 2024; Kuok et al., 2023).

Blended Mentoring: This model of mentoring combines face-to-face meetings with online communication, enabling its participants to take advantage of the best of both models. For example, face-to-face introductory meetings held at the beginning of the term can be followed up with online meetings as the process progresses. This approach helps establish relational trust and ensures a flexible program flow. It is a really useful structure, particularly in relation to flexibility for a range of student needs (Rees Lewis et al., 2018), of both the physical and digital variety. The ability to organize mentoring practices in different ways allows for the development of flexible and effective mentoring models in educational and professional fields. So far, the face-to-face, online and blended type of mentoring has chances that lead to students' success in their studies, integration into society and acquiring of personal skills. Nevertheless, as every model represents strengths and limitations, program designer, need to build mentoring processes based on these comparative differences.

Online Peer Mentoring and Its Effects

Studies in the literature show that online peer mentoring is not merely a temporary solution in times of crisis; rather, it is a comprehensive support mechanism that can contribute to students' development processes in the long term. Positive outcomes in areas such as academic achievement, psychological resilience, and social adjustment indicate that this method should be considered a permanent structure in higher education. Compared to spontaneously developing mentoring relationships, structured programs that are planned and goal-oriented produce more consistent outcomes because they offer students clearer expectations (Omondi et al., 2024). In such programs, the progression of content within a specific framework both facilitates monitoring of the process and ensures that feedback becomes more meaningful. Indeed, a study conducted with university students reveals that supportive peer networks are one of the key determinants of success, particularly in intense and competitive academic environments (Uwimana et al., 2024).

Academic Motivation and Success: Online peer mentoring supports students in adapting to university while also strengthening their interest in and motivation for learning. Research conducted on first-year students shows that quality peer relationships increase class participation and are closely related to academic success (Vania et al., 2022). Students learn by being actively engaged in the learning process when they feel part of a social environment. Interactions such as knowledge sharing, mutual encouragement, and group problem-solving enrich both individual and collaborative learning experiences; these relationships are noted to play a supportive role in challenging academic processes (Stoll et al., 2023; Uwimana et al., 2024). Mentoring programs are generally noted to contribute to the learning process, increase students' commitment to the institution, and have positive long-term effects on education and career development (Crisp & Cruz, 2010). Studies conducted on students in compulsory education also reveal that these programs provide an important support mechanism for young people at high risk of dropping out of school and students from disadvantaged groups (Jablon & Lyons, 2021). In this context, mentoring is considered an effective intervention tool in meeting the needs of students struggling with social isolation, low achievement, or adverse living conditions (Bradley & Corwyn, 2002; Caldarella et al., 2009; McDaniel & Yarbrough, 2016). A process of mentorship based on a relationship of trust has a positive effect on both academic performance and psychosocial adjustment (Rhodes et al., 2006). Recent research has found online peer mentoring to be effective in enhancing academic motivation among university students. Mentoring through regular communication helped students formulate their learning objectives more explicitly, increased their class participation, and improved academic belonging (Vania et al., 2022). For those students who are new to university, the opportunity for peer help not only has a more meaningful learning process in context but also makes the transition period smoother. Experimental studies on this subject also support these findings. Evidence highlights the benefits of group-based online peer mentoring programs in the contexts of first-year students' academic achievement (Higgins et al, 2017), problem solving skills (Miller et al, 2020) and transition (Canning et al, 2019; Smith & Burton, 2013) to university. Likewise, students' study habits and academic success have also benefited from one-to-one online mentoring programs (Hardt et al., 2022).

Psychological Well-Being and Resilience: In addition to academic factors, online peer mentoring plays a major role in students' psychological well-being and resilience as well. Research on this topic shows that students engaging in these programs felt significant reductions in anxiety, increased self-efficacy,

and access to greater emotional support (Robinson Jr., 2025). Results given evidence that online mentorship helped students reduce loneliness and improve their satisfaction with life, especially during the pandemic uncertainty (Shashikala et al., 2022). These findings support the idea that peer mentoring serves as both an academic resource as well as a social support resource with potential for enhancing psychological resilience. Similar results have been observed in one-to-one online mentoring programs conducted with young people with learning differences. These relationships seem to be correlated with positive psychological and behavioral outcomes for participants, including mental health (Mercier et al., 2024). Similarly, Nzama's (2024) study of university students found a significant increase in the psychological resilience levels of students participating in online peer mentoring programs. High scores on the Brief Resilience Scale used in the study indicate that the mentoring process supported students in coping with the academic difficulties brought about by the pandemic. Similarly, research conducted by Ontong and colleagues (2022) acknowledges that the primary purpose of online peer mentoring is to provide academic support, but also notes that the process creates additional benefits beyond this, such as psychological solidarity and social connectedness. Considering the challenges faced by first-year students during the Distance Learning process, online peer mentoring has become an important support mechanism that helps these students develop psychological resilience.

Social Belonging and Adaptation Process: Mentoring programs mainly help students to adjust to university life. And, students who feel supported through relationships they have established with students in the same grades strengthen their sense of belonging to the university. That sense of belonging improves not just a student's academic performance but also a student's growth as a human being (Stoll et al., 2023). Certainly, mentoring programs are said to be correlated with a variety of psychosocial measures, like social skills, self-worth, and sense of belonging (Campbell et al., 2012). In addition, it is noted that trust-based relationships are one of the basic prerequisites for the success of such programs (Rhodes et al., 2006). Online mentoring groups offer a safe place where students can share their feelings freely and connect with peers who have a similar background. Through online engagement, students in such groups become visible and find avenues to create a good academic identity. Research by Gehreke and colleagues (2024) shows that online peer mentoring supports the social and academic adjustment of first-year students in particular. However, the study indicates that the social support offered by online interactions may be more limited than face-to-face interactions. This may make it somewhat more difficult for students to develop resilience in coping with academic pressures. The results indicate that online interactions are complementary to the traditional face-to-face mentoring practices. On the other hand, Risquez's (2011) study indicates that online peer mentoring applications strengthen the sense of community among students and reduce social isolation. It is also stated that these applications support collaborative learning environments and improve students' ability to cope with academic difficulties. These results suggest that online peer-mentoring is a complex tool that promotes the social and academic development of university students. Nonetheless, the small quantity of the studies in the literature signals a need for more extensive research especially among university students.

Discussion, Conclusion, and Suggestions

The literature reviewed in this study suggest that structured mentor–mentee relationships promote focus on academic goals and higher engagement in the learning processes. This is important as different studies indicate that peer Mentoring programmes make a significant difference academically for particularly new students to university (Vania et al., 2022). In addition, important aspects of online mentoring practices are examined. Through online mentoring, students may gain access to an array of emotional support facilities that provide constant assistance in dealing with difficult emotional responses such as anxiety, loneliness, and uncertainty, which boost their psychological resilience levels (Robinson Jr., 2025). Online mentoring applications are also a key ingredient in ensuring that students have a sense of belonging within the university. The ability for students to form social networks where they feel more secure is a significant benefit, particularly for individuals from disadvantaged groups (Stoll et al., 2023). The literature also shows that peer mentoring programs with specific goals and systematic implementation produce more measurable and lasting effects than spontaneous interactions (Omondi et al., 2024; Uwimana et al., 2024). When taken in combination, the results suggest that online peer mentoring is more than a stopgap for responding to the crisis. On the contrary, it is argued that this

model could secure a permanent place in future education strategies due to its flexible structure, which can quickly adapt to different student profiles and changing conditions (Parmar et al., 2025). Mentoring relationships formed via digital platforms assist not only in the access to information by the students but also contribute towards more remote gains in terms of total mental agency, common feeling, and stable performance engagement. Overall, it was concluded that online peer mentoring represents an essential component of the academic and psychological development of university students. Strong peer networks help students manage academic stress, enhance their motivation, and successfully adjust to school life.

Suggestions

For online peer mentoring programs in higher education institutions to achieve a sustainable and effective structure, these programs must be institutionally structured. While peer mentoring programs have positive short-term effects, ensuring continuity in mentoring relationships is often neglected. However, long-term and regular relationships are among the most critical factors determining the impact of mentoring programs (Gehreke et al., 2024). Therefore, having programs with clear goals, monitoring the process at regular intervals, and seeking support from professional consultants when necessary can increase the system's long-term effectiveness (Omondi et al., 2024). It is important to strengthen the psychological support dimension in mentoring processes. Students who transition into university may require additional support with issues like anxiety, self-efficacy, and stress management. Thus, it would be useful to integrate the content of programs with modules related to these issues and reach out to psychological counsellors if needed. Furthermore, it is important to promote inclusive mentoring practices. Peer groups can be tailored that provide support to students who are socioeconomically, culturally, or ethnically disadvantaged. Mentors assigned to these groups can be provided with training on inclusivity and awareness (Stoll et al., 2023). Mentoring programs for graduate students need to be designed within a more specialized framework. Considering the intensity of the research process and high academic expectations, it is important that mentoring at this level supports research skills and facilitates the academic journey (Uwimana et al., 2024). Lastly, regular evaluations and research that use both quantitative and qualitative methods are deemed necessary for tracking the impact of mentoring programs. To enable discrimination in response to needs, feedback from mentors and mentees will also inform content updates, leading to a progressively complete system.

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Technology Leadership in Education and ISTE Standards

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Abstract

Technological innovations and rapid digital transformation have led to the emergence, diversification and expansion of applications, significantly increasing technology's use in learning environments. It has become crucial to adapt to digital innovations in educational environments, develop a vision for technology use and guide all education stakeholders on the proper, reliable, ethical and legal use of technology. However, stakeholders involved in this process must actively adopt innovations, use them in educational environments, create technology-supported learning environments and provide the necessary technological tools and training. To respond to these needs and adapt to digital transformation in education, school administrators must play a key role as technology leaders. Given these requirements, it is important for school administrators to possess strong technology leadership competencies. This study examines the competency framework established by the International Society for Technology in Education (ISTE) for "Educational Leaders", focusing on the technology leadership competencies that educational leaders should possess during the technological transformation of education. It provides a comprehensive examination of how educational leaders demonstrate the knowledge, skills and attitudes required in the digital age. The study also aims to raise awareness among school administrators and teachers of the importance of current technology leadership competencies in education. Furthermore, the study aims to guide the effective implementation of these competencies in educational settings by supporting their development. Furthermore, it emphasises the importance of fostering a collaborative vision in schools by promoting the appropriate and effective use of technology, developing a culture of technology use that supports inclusivity and equity, ensuring continuous professional development and enhancing student learning.

Keywords: ISTE standards, technology leader, digital transformation, educational technology.

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Introduction

In today's educational context, it is of great importance for school administrators and teachers to be able to use technology effectively and to create effective learning environments by ensuring its appropriate integration into educational settings, so that they can carry out their professional duties and adapt to innovations in education. Developing a vision for technology use alongside digital innovations, and providing guidance for the accurate, reliable, ethical, and legal use of technology, have become fundamental responsibilities. This situation not only influences teaching–learning processes but also shapes the structures and strategies of schools. Increasing digitalization necessitates the renewal of educational environments, and within this scope, the roles, duties, and responsibilities of teachers and administrators are observed to be changing (Adnan, 2020; Nayci, 2022).

School leadership in educational institutions has evolved into a structure in which the relationship between technology and learning is managed, innovative learning environments are supported, and digital transformation is guided (Levin & Schrum, 2013). As school administrators and teachers adapt to their changing roles, it becomes increasingly important for them to recognize the digital needs emerging from the acceleration of digital transformation, to meet their professional requirements, and to develop their educational leadership competencies. At this point, the standards developed by ISTE (International Society for Technology in Education) a global community aiming to promote the effective use of technology in education and to comprehensively address digital competencies—serve as a guiding framework for both teachers and school administrators (International Society for Technology in Education [ISTE], 2021; ISTE, 2024b).

ISTE is a global community that establishes standards for learning, teaching, and leadership with technology in schools worldwide and provides a comprehensive roadmap for the effective use of technology. ISTE offers resources to support the professional development of students, educators, education leaders, and coaches in the effective use of educational technologies, and shares innovative approaches and effective practices regarding the efficient use of digital tools (ISTE, 2025c). Studies on technology leadership and teachers' technology integration indicate that leadership based on the ISTE education leadership model significantly supports innovative technology use in instructional processes, school effectiveness, and teacher competencies (Dexter & Richardson, 2020; Raman, Thannimalai, & Ismail, 2019; Yavuzalp & Kartal İncebacak, 2025).

Purpose of the Study

This study addresses, within a comprehensive framework, the ways in which educational leaders reflect the knowledge, skills, and attitudes required by the digital age in line with the ISTE Standards. At the same time, it aims to raise awareness among school administrators and teachers regarding current competencies related to technology leadership in education and the importance of these competencies. The study seeks to guide the effective implementation of these competencies in educational settings by supporting their development.

Significance of the Study

This research makes an important contribution by facilitating an understanding of the changing roles and competencies of educational leaders within the scope of innovations emerging alongside digital transformation in education. By aiming to develop the necessary knowledge, skills, and attitudes related to these roles and competencies, the study provides guidance for their effective implementation in educational environments.

Limitations of the Study

This study does not address different leadership approaches or other models in education; rather, it is limited solely to technology leadership in education and the ISTE Standards for Education Leaders. In addition, the research is restricted to sources published within a specific period and is theoretical in nature. Accordingly, the study is conducted as a review study.

Technology Leadership in Education

In this period of rapid digitalization, the need for strong leadership and effective governance has increased; consequently, concepts such as digital leadership, technology leadership, educational technology leadership, and e-leadership have gained prominence, and school administrators have assumed the role of technology leadership in addition to their traditional roles (Bulut, 2021; Bülbül & Çuhadar, 2012). Within the scope of technology leadership, administrators are expected to possess knowledge about technology, follow technological innovations, serve as role models in this field, and effectively ensure technology integration into the educational process by influencing the school community (Gökoğlu & Çakıroğlu, 2014).

A technology leader in schools can be defined as an individual who establishes and manages the necessary infrastructure for the effective use of information and communication technologies, creates an appropriate environment, and plans the training needed for educators' professional development while motivating and supporting them (Ulukaya, Yıldırım, & Özeke, 2017). On the other hand, Okeke and Dike (2019) define technology leadership as the skills and behaviors required for school administrators to establish and sustain support for the use and integration of information technologies in schools. These skills include developing a vision for technology, planning for effective technology integration, organizing professional development programs for teachers, providing technological infrastructure, evaluating the outcomes of technology use, and keeping up with current technological developments. In this respect, the need for leaders who closely monitor technological advancements and guide innovative practices is emphasized for educational institutions to achieve their goals (Bıdırdı & Kavrayıcı, 2025). While having motivating, guiding, and change-supporting characteristics contributes to school development, school administrators' effective communication skills also strengthen collaboration within schools and enhance the quality of management processes (Bakır, 2022; Daş, Yüksel, & Beşir, 2022). In this context, determining a school's technology vision, preparing strategic plans, and implementing these plans constitute a critical domain of technology leadership (ISTE-EL, 2018). With the technological transformation in education systems, school administrators are expected to be visionary, use technology effectively, follow innovations, and guide teachers. Accordingly, school administrators are regarded as technology leaders within the scope of their roles and responsibilities, such as creating a shared vision, integrating technological opportunities into educational environments, supporting professional development, and providing the necessary resources and infrastructure (Banoğlu, 2011; Günüç, 2017). Moreover, it is stated that the need for leaders who promote the ethical, responsible, and legal use of technology in schools, serve as role models in this regard, monitor innovations in education, and prepare students for the future has increased significantly with the ongoing digitalization process (Bilgiç, 2019; ISTE, 2018).

For educational leaders of the digital age, developing a technology vision, leading technology integration, providing the necessary infrastructure, supporting teachers, and encouraging them to use technology are of great importance in establishing the required school culture and shaping learning environments (Banoğlu et al., 2023; Richardson, Flora, & Bathon, 2013). School administrators who recognize the significant contributions of technology to instructional and administrative processes need to develop awareness in this area. Indeed, successful technology integration is associated with administrators' abilities to manage the digitalization process and their technological leadership competencies (Görgülü, Küçükali, & Ada, 2013; Håkansson-Lindqvist & Pettersson, 2019).

ISTE Standards

Founded in 1979, the International Society for Technology in Education (ISTE) is a global community of educators that supports the effective use of technology in education and provides a roadmap by establishing standards for students, educators, education leaders, and coaches to ensure successful implementation in schools. Through the standards it has developed, ISTE creates a perspective aimed at transforming teaching by using technology accurately and meaningfully, and offers a common framework applicable across countries (ISTE, 2018).

In 2023, ISTE joined forces with ASCD (The Association for Supervision and Curriculum Development), founded in 1943, to create more effective teaching and learning environments (ISTE, 2025). In addition, in order to respond more effectively to the rapid pace of technological developments, emerging educational needs associated with advances in artificial intelligence, and the demands of the contemporary era, ISTE updated its standards in 2024. These updates aimed to respond more robustly

to change by renewing the standards through gradual and annual revisions, thereby adapting to the rapid transformations in technology. With this renewed model, the goal was to provide a more effective response to rapid developments in educational technologies. Among the main drivers of this change are a 765% increase in the use of educational technologies over the past six years, the rapid expansion of digital integration following the pandemic, and the transformative effects of artificial intelligence on education. Indeed, these factors have made it necessary to restructure instructional processes and to establish learning environments aligned with the requirements of the digital age. The ISTE 2024 Standards include separately defined standards for students, educators, coaches, and education leaders (ISTE, 2024a), which are presented in Figure 1.



Figure 1. ISTE Standards

The purpose of the ISTE Standards for Students is to empower students by giving greater emphasis to their voices, ideas, and preferences in technology-rich environments, and to make the learning process more student-centered. Within this framework, students demonstrate development across seven core competency areas: empowered learner, digital citizen, knowledge constructor, innovative designer, computational thinker, creative communicator, and global collaborator (ISTE, 2024c).

The purpose of the ISTE Standards for Educators is to ensure that students take an active role in their learning processes and to continuously improve instructional practices. Accordingly, educators gain competence in the roles of learner, leader, citizen, collaborator, designer, facilitator, and analyst, thereby making the teaching process more effective, interactive, and student-centered (ISTE, 2024d).

The purpose of the ISTE Standards for Coaches is to define the role of educational technology coaches and to support them in creating high-impact, sustainable, and equitable learning environments. Within this scope, coaches contribute to the effective, informed, and inclusive use of technology in education by assuming the roles of change agent, connected learner, collaborator, learning designer, professional learning facilitator, data-driven decisionmaker, and digital citizenship advocate (ISTE, 2024e).

The purpose of the ISTE Standards for Education Leaders is to support increased student learning by empowering teachers and coaches. Accordingly, education leaders act as digital citizenship advocates, visionary planners, empowering leaders, system designers, and connected learners, strategically guiding technology integration in education, fostering the development of inclusive learning environments, and supporting continuous improvement (ISTE, 2024b). Education leaders strengthen digital literacy and support teachers in the use of artificial intelligence, thereby establishing a safe, ethical, and inclusive technology culture within learning environments (Echols, 2024).

ISTE Standards for Education Leaders

In the early 1990s, fundamental principles regarding the competencies of school administrators were established in the United States, and standards were developed to define their technological competencies (Hancock & Fulwiler, 2007). To define and standardize these competencies, various initiatives were launched in 2001, and under the leadership of the

International Society for Technology in Education (ISTE), a set of standards titled NETS-A

(National Educational Technology Standards for Administrators) was published (Richardson, Bathon, Flora, & Lewis, 2012). The NETS-A Standards introduced in 2002 consisted of the following dimensions: (1) Leadership and Vision, (2) Learning and Teaching, (3) Productivity and Professional Practice, (4) Support, Management, and Operations, (5) Assessment and Evaluation, and (6) Social, Legal, and Ethical Issues.

In 2009, the NETS-A Standards were updated and reorganized under the dimensions of (1) Visionary Leadership, (2) Digital-Age Learning Culture, (3) Excellence in Professional Practice, (4) Systemic Improvement, and (5) Digital Citizenship (ISTE, 2009). These standards encompass the technological knowledge, skills, and practices required for school administrators to use technology effectively (Schrum, Galizio, & Ledesma, 2011).

In order to make effective use of technology in education at an international level, the International Society for Technology in Education (ISTE), headquartered in the United States, re-established standards outlining how students, educators, education leaders, and coaches are expected to approach technology use in classrooms (ISTE, 2021). These standards became known as the ISTE (2018) Standards, and NETS-A was renamed the ISTE Standards for Education Leaders (ISTE-EL Standards). For ISTE, establishing standards for students and educators alone is not sufficient. For a school to be truly successful, all stakeholders involved in the educational process must be included, and this also applies to administrators. As education leaders, school administrators ensure that teachers are equipped to actively use technology to meet the learning needs of all students. They engage others in creating a vision, strategic plan, and ongoing evaluation cycle for learning with technology, foster a school culture in which teachers and students are empowered to use technology in innovative ways to enrich teaching and learning, and establish teams and systems to implement, sustain, and continuously improve the use of technology to support learning (ISTE, 2021).The 2024 updates to the ISTE Standards place a strong emphasis on the role of artificial intelligence in education, highlighting the competencies required for its safe, informed, and innovative use. In parallel, the standards for education leaders were also updated, with a particular emphasis on reducing opportunity and achievement gaps by considering the impacts of artificial intelligence on equity and inclusion. The most prominent changes were observed within the Digital Citizenship Advocate standard, focusing on ethical use, critical thinking, and digital literacy (ISTE, 2024a). The evolution of the ISTE Standards for Education Leader from 2002, 2009, and 2018 to the current 2024 version is illustrated in Figure 2.



Figure 2. ISTE Standards for Education Leaders (ISTE, 2002; ISTE, 2009; ISTE, 2018; ISTE, 2025b)

Within the framework of the ISTE Standards for Education Leaders, an education leader is defined through the roles of digital citizenship advocate, visionary planner, empowering leader, system designer, and connected learner (ISTE, 2024b).

Digital Citizenship Advocate

Leaders ensure that all students actively use technology for learning and develop digital citizenship skills.

a) *Qualified Educators:* Ensure all students learn from educators who are skilled in using technology to create authentic and engaging learning experiences.
b) *Equitable Access to Technology:* Ensure access to technology, connectivity, inclusive digital content and learning environments that meet the needs of all students.
c) *Modeling Digital Citizenship:* Model the use of technology in inclusive, healthy ways to solve problems and strengthen community.
d) *Safe and Ethical Use of Technology:* Model the safe, ethical, and legal use of technology and the critical examination of digital content.
e) *Student Use of Technology:* Leaders ensure all students engage in the active use of technology for learning and build their digital citizenship skills (ISTE, 2024b).

Visionary Planner

This role refers to guiding the process of technology integration in education with a long-term, strategic, and inclusive perspective. Leaders involve others in creating a vision, a strategic plan, and a continuous evaluation cycle to transform learning through technology.

a) *Developing and Sustaining a Vision:* Include a wide range of perspectives from the community to develop and sustain a vision for using technology to advance student learning and success.
b) *Collaborative Strategic Planning with Stakeholders:* Build on the shared vision by collaboratively creating a strategic plan that articulates how technology will be used to enhance learning.
c) *Evaluating the Plan and Continuous Improvement:* Evaluate progress on the strategic plan, make course corrections, measure impact and scale effective approaches for using technology to transform learning.
d) *Effective Communication and Data Collection with Stakeholders:* Communicate effectively with stakeholders to gather input on the plan, celebrate successes and engage in a continuous improvement cycle.
e) *Sharing Learning Outcomes:* Share lessons learned, best practices, challenges and the impact of learning with technology with other education leaders who want to learn from this work (ISTE, 2024b).

Empowering Leader

This role represents a leadership approach that authorizes, supports, and encourages teachers and students in the use of technology. Leaders create a culture in which teachers and learners can use technology in innovative ways to enrich teaching and learning.

a) *Empowering Educators:* Empower educators to exercise professional agency, build teacher leadership skills and pursue personalized professional learning.
b) *Developing Educator Competence:* Build the confidence and competency of educators to put the ISTE Standards for Students and Educators into practice.
c) *Fostering a Culture of Innovation:* Inspire a culture of innovation, creative problem-solving, and collaboration that allows the time to explore and develop teaching practices using digital tools.
d) *Using Technology to Address Individual Student Needs:* Support educators in using technology to advance learning that meets the diverse learning, cultural, and socialemotional needs of individual students.
e) *Using Analytics to Monitor Student Achievement:* Develop learning assessments that provide a personalized, actionable view of student progress in real time (ISTE, 2024b).

System Designer

This role emphasizes leadership competencies that effectively guide technology integration and promote transformation in learning environments. Leaders establish teams and systems to implement, sustain, and continuously improve the use of technology to support learning.

a) *Developing Equitable Technology Policies:* Guide teams to establish equitable technology policies that support effective learning.
b) *Providing Adequate and Scalable Resources:* Ensure that resources and infrastructure for supporting effective use of technology for learning are sufficient and scalable to meet future demand.
c) *Protecting Privacy and Security:* Protect privacy and security by ensuring that students and staff observe effective privacy and data management policies.
d) *Establishing Strategic Partnerships:* Establish partnerships to advance strategic plans, achieve learning priorities and develop opportunities for students to gain realworld experience (ISTE, 2024b).

Connected Learner

This role emphasizes education leaders' openness to continuous learning, their support for personal development through technology, and their participation in professional learning communities. Leaders engage in continuous professional learning for themselves and others, model the learning process, and encourage learning.

Staying Current on Innovations in Learning: Set goals to remain current on emerging technologies for learning, innovations in pedagogy and advancements in the learning sciences.

Participation in Online Personal Learning Networks: Participate regularly in online professional learning networks to collaboratively learn with and mentor other professionals.

Engaging in Reflective Practice: Use technology to regularly engage in reflective practices that support personal and professional growth.

Driving Continuous Improvement and Leading Change: Develop the skills needed to lead and navigate change, advance systems and promote a mindset of continuous improvement for how technology can improve learning (ISTE, 2024b)

Conclusion and Recommendations

In light of the developments emerging during the digital transformation process and the rapidly increasing pace of innovation, it is evident that school administrators must possess the necessary technology leadership competencies, promote the appropriate and effective use of technology, foster a shared vision based on collaboration, and cultivate a culture of technology use that supports inclusivity and equity. In alignment with the ISTE Standards for Education Leaders, ISTE emphasizes visionary and equity-oriented leadership in educational technology. Furthermore, it highlights that leaders should ensure the inclusive, accessible, and transformative integration of technology into schools in order to create equitable, effective, and sustainable learning environments for all students (Abshire et al., 2024). In the digital transformation process, school administrators assume the role of technology leaders in addition to their traditional roles, and this role is critical in shaping a school's technology vision and in the development of strategic plans (Bülbül & Çuhadar, 2012; ISTE-EL, 2018). This study addresses education leaders within the framework of the ISTE Standards through the roles of digital citizenship advocate, visionary planner, empowering leader, system designer, and connected learner (ISTE, 2025b).

Competencies such as adapting changing educational environments to technologysupported learning, encouraging and modeling continuous professional development for teachers, and guiding the accurate, reliable, ethical, and legal use of technology are among the core responsibilities of today's education leaders. School administrators with strong technological competencies significantly contribute to the effective integration of technology into learning environments by serving as role models for teachers in technology use (AlAjmi, 2022). Moreover, education leaders are expected to continuously monitor

technological developments, maintain up-to-date knowledge, and exemplify effective technology use within the school community (Gökoğlu & Çakıroğlu, 2014; Günüç, 2017).

Based on the findings of this study, it is recommended that school administrators participate in regular professional development activities to keep their technology leadership competencies up to date and encourage other teachers in their schools to do the same. They should continuously enhance their skills in the pedagogically effective use of digital tools and serve as role models in this regard. Education leaders should promote technology-supported learning processes in their schools by developing a clear and sustainable vision for technology use with the participation of all stakeholders, determine the necessary strategies through collaborative engagement, regularly evaluate these processes, and ensure that appropriate adjustments are made. Furthermore, school administrators should consider equity of opportunity within their schools by facilitating students' and teachers' access to technological tools, taking necessary measures to ensure ethical and secure use, and demonstrating exemplary practices in all these areas. Collaboration and knowledge sharing with internal and external stakeholders should be strengthened to identify strategies that ensure the sustainability of technology use. In addition, it may be beneficial to measure the impact of implemented plans on instructional processes and student learning through appropriate feedback mechanisms.

Regarding recommendations for future research, technology leadership in education may be examined through different leadership approaches and models beyond the ISTE Standards. Field-based studies may be conducted to investigate how education leaders develop their technology leadership competencies in practice and how these competencies are reflected in student learning outcomes. Further research may explore the long-term effects of technology leadership practices on educational environments, teacher behaviors, school culture, and student achievement. Comparative studies may be carried out to identify differences in technology leadership practices across educational levels such as primary, secondary, and high schools. Additionally, practice-oriented studies aimed at supporting the professional development of school administrators in relation to the ISTE Standards for Education Leaders and technology leadership may be conducted. Finally, conducting research on the ISTE Standards for Students, Educators, and Coaches—alongside the Standards for Education Leaders—can be considered important for examining technology use in schools from multiple dimensions and for raising awareness among stakeholders.

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The Role of School Textbooks In the Development of Linguistic Competence In Primary Education: An Analysis From the Perspective of Teachers In Kosovo

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Abstract

This representative study examines the extent to which Albanian language textbooks for primary education contribute to the development of students' linguistic competence. A mixed methods approach was employed, combining quantitative data from 20 closed ended questionnaire items with qualitative insights from open ended responses. The questionnaire, developed based on existing literature, demonstrated high internal consistency (Cronbach's alpha = 0.82). The sample comprised 200 primary school teachers, purposefully selected to represent diverse regions, teaching experiences, and school contexts. Findings indicate that 68% of teachers consider the textbooks effective in promoting fundamental language skills, including reading comprehension and vocabulary enrichment. However, 54% reported a lack of variety in open ended and creative writing tasks, 58% noted limited opportunities for contextualized language use, and 52% observed excessive repetition of exercises. Teachers highlighted that these limitations restrict opportunities for discussion, argumentation, and problem solving, thereby hindering the full achievement of linguistic competence objectives. It is recommended that future textbook designs incorporate a broader range of interactive and authentic language tasks, integrate real life communication contexts, and include activities that foster higher order thinking. Such targeted enhancements could substantially improve the textbooks' effectiveness in supporting students' linguistic development.

Keywords: parents with children with special needs, perceived stress, perceived social support

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Introduction

Linguistic competence constitutes a central aspect of students' cognitive and communicative development, encompassing the abilities to understand, produce, and communicate effectively through language. In primary education, textbooks serve as the principal medium for delivering language knowledge, skills, and cultural values, playing a pivotal role in fostering basic literacy and communication abilities. In the context of education in Kosovo, Albanian language textbooks significantly influence students' linguistic skill development and contribute to their communicative competence. Recent curricular reforms in Kosovo have emphasized competence based education, aiming to develop students' linguistic, cognitive, and social abilities in an integrated manner. Despite these reforms, the practical implementation of linguistic competence through textbooks remains a challenge. Teachers, as the primary implementers of the curriculum, frequently report concerns regarding the quality, pedagogical design, and relevance of the textbooks currently in use.

The present study aims to investigate teachers' perceptions regarding the role of Albanian language textbooks in developing students' linguistic competence in primary education. Specifically, it seeks to examine how textbooks contribute to reading comprehension, vocabulary enrichment, creative writing, contextualized communication, and problem solving skills. This study addresses the following research questions:

1. To what extent do Albanian language textbooks for primary education contribute to the development of students' linguistic competence?
2. How do teachers perceive the opportunities provided by current textbooks to promote creative writing, discussion, and problem solving?

Guided by these questions, the study tests two hypotheses: H1 posits that Albanian language textbooks significantly contribute to students' linguistic competence, particularly in reading comprehension and vocabulary enrichment, while H2 suggests that teachers perceive the current textbooks as offering limited opportunities for creative writing, contextualized communication, and problem solving, which may restrict the full achievement of linguistic competence objectives. By exploring these questions and hypotheses, the study intends to provide insights for textbook authors, curriculum developers, and educational policymakers, emphasizing the need for improvements in textbook design that align with active, meaningful learning and support real life language use among primary school students.

Literature Review

The role of textbooks in language learning

Textbooks remain one of the most influential instructional tools in formal education. They not only structure the content of teaching but also determine the pedagogical approaches employed by teachers. In language education, textbooks are central to promoting reading, writing, listening, and speaking skills (Tomlinson B. , 2011). Well designed textbooks should integrate a variety of tasks that engage learners in authentic communication, promote creativity, and foster higher order thinking (Tom & Torres, 1994). A number of contemporary studies have examined how school textbooks influence the development of language competencies, the promotion of critical thinking, and the shaping of teachers' pedagogical practices. (Khan & Liaqat, 2024) In an empirical study conducted with secondary school teachers in Pakistan, the effectiveness of English textbooks in achieving the communicative objectives of the curriculum was analyzed. The findings indicate that teachers positively evaluate the organization of the material and the clarity of the content, but they emphasize the lack of interactive activities and exercises that promote authentic classroom communication. This suggests that, although the textbooks support basic language development, they have limitations regarding the practical use of the language. Along similar lines, (Pingping, 2019) examines the interaction created by English textbooks and the level of linguistic and cultural contextualization they provide. The study shows that many of the textbooks are disconnected from the students' sociocultural reality, limiting their ability to transfer language skills to real communicative situations. This research emphasizes the importance of textbooks reflecting authentic contexts and offering a balance between language knowledge and functional language use.

In the context of Kosovo, (Ismajli & Neziri, 2019) analyze the role of school textbooks in the development of critical thinking among fifth grade students, using Facione's dimensions as an analytical framework. The findings indicate that the textbooks primarily contain reproductive tasks, with a lack of activities requiring analysis, evaluation, and deep reflection. As a result, although the textbooks may support basic language competencies, they do not provide sufficient space for the development of independent thinking. Finally, the study by (Azemi & Lumnie, Aparatura didaktike ne tekstet shkollore, 2013) on didactic apparatus in lower and secondary education textbooks in Kosovo emphasizes the importance of supportive elements such as illustrations, diagrams, tables, and guiding questions. The results show that, although the textbooks contain important didactic elements, their use by teachers is uneven and often not aligned with the function intended by the textbook authors. This suggests that the effectiveness of didactic apparatus depends not only on its quality but also on how teachers integrate it into teaching.

Together, these studies demonstrate that school textbooks remain important teaching tools but often present limitations in terms of contextualization, authentic communication, critical thinking, and the use of didactic apparatus.

Linguistic competence and its components

The concept of key competencies in education does not only include the mastery of knowledge but also the abilities to think, communicate, and act independently (Development., 2018), (Commission, 2019) and (Rychen & Salganik, 2003). These competencies are interconnected and require learning content that promotes interaction, reflection, and practical (Voogt & Roblin, 2012). Language competencies are considered fundamental for all areas of learning, as they support understanding, processing, and expressing ideas clearly and logically (Europe, 2020). In this context (Cummins, 2000) emphasizes that the development of language skills is closely linked to the use of language in authentic and experience related contexts for students. (Chomsky, 1965) introduced the concept of linguistic competence as the innate ability of speakers to produce and understand grammatically correct sentences. This foundational idea highlights that humans possess an inherent knowledge of linguistic rules that enables comprehension and production. Later, (Hymes, On communicative competence, 1972), expanded this concept into communicative competence, emphasizing the social and contextual dimensions of language use, including the ability to select appropriate language forms according to different settings and purposes. In the context of primary education, linguistic competence encompasses several interrelated skills: phonological awareness, vocabulary acquisition, syntax mastery, comprehension, and expressive communication. According to (Jack & Richard, 2010) these skills are most effectively developed when learners engage in meaningful language tasks that promote authentic communication and active use of the language.

Textbook design and competence based education

In the context of Kosovo, there are no studies that specifically examine the impact of Albanian language textbooks on the development of Albanian language competencies in primary education. Existing local research focuses mainly on textbooks for mathematics or English language, targeting lower secondary (grades 6–9) or upper secondary education. This gap highlights the need to investigate how textbooks can support language learning at the primary level. Modern textbooks are expected to reflect competence based frameworks, aligning content with learning outcomes that promote knowledge, skills, and attitudes. International studies provide insights into the potential and limitations of primary school textbooks. For example, (Gila, 2019) points out that English language textbooks in primary education do not always promote practical language use in authentic contexts. (Bureković & Rizvić-Eminović, 2025) analyzed two primary school textbooks in Bosnia and found that they focus mainly on language structures and vocabulary, offering few interactive activities. In competence oriented systems such as Kosovo's, textbooks should enable learners to apply language knowledge in authentic contexts, thereby bridging the gap between theory and practice. In the article Implementation of Standards for School Textbooks in Reading Books (Grades one-five), (Mexhuni, 2015), examines the reading textbooks used in grades one-five and identifies several shortcomings related to instructional content, pedagogical and methodological aspects, illustrations, and gender equality. The study concludes that these textbooks do

not fully comply with the standards developed by MEST in collaboration with KEC and therefore need to be replaced, as they are not aligned with the new curriculum.

Teachers' perceptions of textbook effectiveness

Throughout the twentieth century, school textbooks played a decisive role in shaping the education of future generations. They served as the main foundation of the curriculum and were often regarded as equivalent to the curriculum itself. If one were to ask teachers or the general public what the curriculum for a school year or a specific subject consists of, the most common answer would be: the textbook (Orstein & Hukins, 2003). International studies show that teachers' perceptions of textbook effectiveness are an important source for evaluating textbook quality. In the international context, studies indicate that primary school textbooks often rely mainly on the reproduction of knowledge and focus on structural content, offering few opportunities for authentic use and real communication situations (Samat & Rosli, 2020). In some cases, even when textbooks contain guidance and didactic elements, teachers' use of these materials does not always maximize their potential for practical and creative learning (Essuman, 2024).

Identified gaps and rationale for the study

Despite ongoing curriculum reforms, little empirical research has been conducted in Kosovo to examine how primary school textbooks (grades one–five) practically contribute to the development of the Albanian language competencies outlined in the curriculum. Existing studies have focused mainly on curriculum implementation or the content analysis of textbooks in other subjects, without exploring teachers' direct experiences and evaluations. This study fills this gap by systematically analyzing teachers' perceptions of the effectiveness and limitations of Albanian language textbooks in promoting linguistic competence in primary education.

Research Aim and Questions

Research aim

The aim of this study is to measure teachers' perceptions regarding the role of Albanian language textbooks in the development of students' linguistic competence in primary education. The study also seeks to identify the strengths and limitations of the current textbooks, examining how they influence the development of students' reading comprehension, vocabulary enrichment, creative writing, and communicative skills.

Research Questions

- **Main research question (RQ1):** To what extent do Albanian language textbooks for primary education contribute to the development of students' linguistic competence?
- **Supporting research question (RQ2):** How do teachers perceive the opportunities provided by current textbooks to promote creative writing, discussion, and problem solving?

Research Hypotheses

- **Primary hypothesis (H1):** Albanian language textbooks for primary education significantly contribute to the development of students' linguistic competence, particularly in areas such as reading comprehension and vocabulary enrichment.
- **Secondary hypothesis (H2):** Teachers perceive that current textbooks provide limited opportunities for creative writing, contextualized communication, and problem solving, which restricts the full achievement of linguistic competence objectives.

Variables

Table 1.

Types of variables

Type	Variable	Description

Independent variable	Quality and design of Albanian language textbooks	Refers to the pedagogical structure, task variety, contextualization, and interactivity of textbooks.
Dependent variable	Development of students' linguistic competence	Includes reading comprehension, vocabulary growth, creative writing, and communicative ability.
Control variables	Teaching experience, school location, and educational level	These factors may influence teachers' perceptions but are not the main focus of the study.

Methodology

Research design

This study is a **representative study** and employed a **mixed methods design**, combining quantitative and qualitative approaches to provide a comprehensive understanding of the issue. The quantitative component focused on analyzing teachers' responses to structured questionnaire items, while the qualitative component explored teachers' open ended reflections regarding textbook effectiveness and classroom application.

Reliability of the instrument

The internal consistency of the questionnaire was assessed using **Cronbach's Alpha**, which yielded a value of **0.82**. This indicates a high level of reliability, confirming that the instrument consistently measures teachers' perceptions of the effectiveness of Albanian language textbooks in developing students' linguistic competence.

Table 1.
Cronbach's Alpha

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.82	.82	15

Population and sample

The study population consisted of primary school teachers in Kosovo, teaching from grades one to five. Using purposive sampling, 200 teachers from different regions (urban and rural schools) were selected to ensure representativeness across the educational context. The sample included teachers with varying years of experience and educational backgrounds.

Sample of the study

The study sample consisted of 200 primary school teachers, from grades one to five, across Kosovo. Participants were selected using purposive sampling, ensuring representation from both urban and rural schools, as well as from different municipalities. The selection aimed to include teachers with diverse teaching experiences.

Table 2.
Demographic characteristics of teachers

Variable	Category	N	Percentage (%)
Gender	Female	152	76
	Male	48	24
Teaching experience	1–5 years	40	20
	6–15 years	96	48
	Over 15 years	64	32
School location	Urban	116	58
	Rural	84	42

Grade levels taught	Grades 1–3	94	47
	Grades 4–5	106	53

Research instruments

Questionnaire design

The primary data collection instrument in this study was a structured questionnaire, specifically designed to measure teachers' evaluations of Albanian language textbooks. The questionnaire was divided into three main sections, each targeting a different dimension of analysis:

Textbook content and structure: examines the clarity, organization, relevance, and alignment of the content with curriculum objectives.

Practical application in the classroom: assesses how well the textbooks support the development of linguistic competence through reading comprehension, vocabulary enrichment, creative writing, and contextualized communication.

Teachers' challenges and recommendations: identifies the difficulties teachers encounter when implementing textbook activities and their suggestions for improvement.

The questionnaire included a total of 20 items:

15 losed ended questions using a five point Likert scale (1 = strongly disagree to 5 = strongly agree), and

5 open ended questions to collect personal perceptions and qualitative insights from teachers.

Data Analysis Techniques

Quantitative data from closed ended questions were analyzed using **descriptive statistics** to identify trends in teachers' perceptions.

Qualitative data from open ended questions were analyzed through **thematic coding**, allowing the identification of key themes such as: task variety, contextual learning and creative engagement.

Analysis of the Data Results From Quantitative Data

The selection of key variables for the statistical analysis (focusing on Sections B, D, and E) was based on their direct connection to the research objective: "The Role of School Textbooks in the Development of Linguistic Competence in Primary Education."
These sections were chosen to cover three critical areas of assessment:

Main sample findings: The sample is dominated by females (97.5%) and teachers aged 31-40 (44.5%). The vast majority (85%) have attended professional training on the use of textbooks.

Analysis from quantitative data

Evaluation of the content and quality of school textbooks (Section B)

Objective: To measure teachers' fundamental perception of the academic and didactic quality of the school textbooks.

Primary focus: To assess whether teachers believe that the content (including its appropriateness and encouragement of critical thinking) adequately meets the needs for the development of linguistic competence in accordance with the curriculum.

Table 3.

Results for section B; *Teachers' attitudes toward textbook effectiveness*

Question	% Agree	% Neutral	% Disagree	Trend (Main Attitude)
Q6. Develops linguistic competence	63%	18%	19%	High Agreement
Q7. Relates to life experiences	61%	19%	20%	High Agreement
Q8. Encourages critical thinking	58%	23%	19%	Moderate Agreement
Q9. Reading sections are appropriate	74%	15%	12%	Very High Agreement

Main takeaway for section B: Teachers hold a very positive view of the textbook content, particularly regarding the appropriateness of the reading sections. While still positive, the agreement is noticeably lower on the textbook's ability to encourage critical thinking.

Evaluation of the impact of school textbooks on academic outcomes (Section D)

Objective: To verify whether, in teachers' opinion, the textbook has a measurable and positive effect on student performance and inclusion.

Primary focus: The direct link between school textbooks and the continuous improvement of language skills, as well as the inclusion of all students in the learning process.

Table 4.

Results for section D; Teachers' attitudes toward textbook support for linguistic development

Question (Attitude)	% Agree Total (n)	% Neutral (n)	% Disagree Total (n)	Trend
Q17: Helps include all students	75% (150 teachers)	11% (22 teachers)	14% (28 teachers)	Very High Agreement
Q16: Continuous language improvement thanks to textbooks	60% (120 teachers)	20% (40 teachers)	20% (40 teachers)	High Agreement

Main takeaway for section D: Teachers strongly believe that the textbooks are effective in promoting inclusive education. A smaller, though still high, majority agree that the textbooks lead to continuous language improvement in students.

Analysis from qualitative

Analysis of teachers' attitudes regarding the improvement of school textbooks (Section E)

Objective: To identify critical areas requiring changes and to uncover teacher consensus on future improvements.

Primary focus: To highlight the strong demand for more modern textbooks and the need to increase exercises that stimulate reflection and critical thinking, thereby serving as a basis for recommendations.

Table 5.

Results for section E; *Attitudes and suggestions*

Question (Attitude)	% Agree Total (n)	% Neutral (n)	% Disagree Total (n)	Trend
Q20: Better results if the textbooks were more modern	85% (170)	10% (20)	5% (10)	**Very High Agreement**
Q22: Desire for more functional exercises	70% (140)	25% (50)	5% (10)	**High Agreement**
Q23: Lack of exercises that encourage critical thinking	65% (130)	17.5% (35)	17.5% (35)	**High Agreement**

Main takeaways for section E: This section reveals the teachers' critical feedback and specific suggestions for improvement, which is some of the most valuable data in the survey. This includes: Strong demand for modernization: The most powerful finding is for Q20, where an overwhelming 85% of teachers agree that student results would be better with more contemporary textbooks. This indicates a clear perception that the current textbooks need to be revised. Call for practical and critical skills: The high agreement for Q22 (70%) and Q23 (65%) points to a specific direction for improvement. Teachers are explicitly asking for: More functional exercises; More exercises that develop critical thinking skills. Consistency with previous findings: The concern about a lack of critical thinking exercises (Q23) directly echoes the more moderate agreement in Section B (Q8), where encourages critical thinking received the lowest agreement score (58%) on the content evaluation. This reinforces that critical thinking is a key area perceived as lacking.

Overall conclusion from section E: While teachers find the current textbooks useful (as seen in Sections B and D), they see significant room for improvement. There is a strong, collective voice calling for the modernization of content and a shift towards more practical, functional, and critically engaging exercises.

ANOVA Analysis

ANOVA was conducted to examine whether teachers' perceptions varied based on factors such as teaching experience or school location.

Table 6.

ANOVA Teachers' perceptions by teaching experience and school location

Source	df	F	p	η^2
Teaching Experience	3	1.12	0.34	0.02
School Location	1	0.87	0.35	0.004

The results indicated no significant differences between the groups (e.g., teaching experience: $F(3,196) = 1.12$, $p = 0.34$, $\eta^2 = 0.02$; school location: $F(1,198) = 0.87$, $p = 0.35$, $\eta^2 = 0.004$). This suggests that perceptions regarding the effectiveness and limitations of the textbooks are relatively consistent across the sample.

Findings and discussion

General effectiveness of textbooks

The findings reveal that a significant majority of teachers 68% perceive the Albanian language textbooks for primary education as effective in developing basic linguistic skills, particularly in reading comprehension and vocabulary enrichment**.** This confirms the primary hypothesis (H1)**,** which posited that textbooks play a substantial role in supporting foundational language acquisition. Teachers emphasized that the structured exercises and graded reading materials in the textbooks facilitate the gradual development of students' reading fluency and comprehension abilities. The textbooks also contribute to systematic vocabulary building, as they introduce new words through contextualized texts and controlled practice. These results are consistent with findings from international research indicating that textbooks provide stability, coherence, and pedagogical guidance in the teaching process (Cunningsworth, 1995; Tomlinson, 2011). Similarly, in the Kosovar context, the textbooks appear to fulfill their core instructional function**,** serving as the main reference for both teachers and learners.

Identified limitations in textbook design

Despite their overall effectiveness in supporting basic skills, teachers identified several critical limitations that restrict the broader development of linguistic competence. Specifically:

- **54%** of respondents reported a **lack of variety** in open ended and creative writing tasks
- **58%** noted **limited opportunities for contextualized language use**
- **52%** observed **excessive repetition of exercises** across units.

These limitations reflect teachers' perceptions that textbooks remain **too** structurally oriented and insufficiently interactive**,** focusing heavily on grammar and mechanical exercises rather than communicative and creative language use. The effectiveness of language learning materials depends on the balance between controlled practice and authentic communication**.** The lack of contextual and creative tasks in the current textbooks, therefore, limits students' opportunities to engage in higher order linguistic processes such as interpretation, synthesis, and evaluation key components of Bloom**'s** taxonomy (Anderson & Krathwohl, 2001).

Impact of limitations on classroom practice

Teachers emphasized that the repetitive and closed ended nature of tasks reduces opportunities for discussion**,** argumentation, and problem solving in the classroom. As one respondent noted, "Most activities ask students to reproduce correct answers rather than to think, create, or express opinions." This finding supports the secondary hypothesis (H2**)** that current textbooks provide limited space for creativity and interaction**.** Without adequate exposure to communicative and problem based tasks, students' linguistic competence remains restricted to basic comprehension and reproduction**,** rather than progressing toward expressive and critical use of language. Furthermore, the absence of contextualized exercises disconnects textbook learning from real life communication**,** a core component of competence based education (Hymes, On communicative competence, 1972) (Richards & Rodgers, 2001).Tasks that simulate authentic scenarios such as dialogues, project based writing, and peer collaboration are largely underrepresented, weakening the connection between language learning and its social application.

Teachers' reflections and suggested improvements

The qualitative responses offered by teachers reinforce the quantitative findings. Many teachers called for **diversified task types**, suggesting the integration of:

- Creative and open ended writing activities
- Role plays, dialogues, and group discussions to foster communication
- Problem solving and project based learning tasks
- Multimodal resources such as visuals, diagrams, and digital tools to support comprehension
- Locally relevant examples that reflect students' cultural and linguistic environment.

These suggestions align with pedagogical recommendations by (Hutchinson & Torres, 1994) and (Tomlinson B. , 2011) who emphasize the need for textbooks to evolve into interactive learning tools rather than static repositories of information. Teachers also highlighted the importance of teacher support materials, including guides with methodological advice, sample lesson plans, and assessment models. Such resources would enable more consistent and effective implementation of textbook activities across schools.

Interpretation of findings in relation to literature

Overall, the findings corroborate previous international research asserting that textbooks are indispensable for basic literacy development but often insufficient for fostering communicative competence (Bayram, 2000). In Kosovo, this study extends existing research (Mexhuni, 2015) by providing evidence that teachers perceive both the value and the shortcomings of current Albanian language textbooks. The findings highlight a tension between curricular intentions which promote

competence based education and textbook design**,** which remains predominantly knowledge driven. To bridge this gap, textbooks should incorporate authentic, creative, and collaborative activities that support both cognitive and social dimensions of language learning. (Azemi & Morina, Aparatura didaktike në, 2013) kanë konstatuar që nevoja për përmirësimin e aparaturës didaktike në tekstet shkollore është e konsiderueshme.

Conclusions

Based on the analysis of data collected from 200 primary school teachers in Kosovo, the study confirms that Albanian language textbooks play an important role in developing basic linguistic competencies, particularly in the areas of reading comprehension and vocabulary enrichment. This finding aligns with the primary hypothesis (H1) and indicates that the textbooks provide structured and consistent content for developing fundamental language skills. However, the study also reveals significant limitations. Most teachers emphasize that the current textbooks do not offer sufficient opportunities for creative writing, contextualized communication, and problem solving. The activities are mainly reproductive and closed ended, which restricts the development of critical thinking, argumentation, and linguistic interaction. These findings support the secondary hypothesis (H2), which states that the current textbooks do not fully meet the requirements of the competence based approach. From the qualitative analysis, teachers highlight the need for more authentic and contemporary activities that relate to real life communication situations and encourage creativity, collaboration, and functional use of language. This indicates a mismatch between the goals of the new curriculum and the way textbooks are designed and implemented in practice. Overall, the study concludes that although Albanian language textbooks in the primary cycle contribute to the development of basic linguistic competencies, they require substantial revision and improvement in order to support the full development of students' linguistic and communicative competencies.

Suggestions

1. **Revise and modernize the didactic apparatus**
   Textbooks should include clearer illustrations, diagrams, and graphic organizers that help students understand and apply language concepts.
2. **Integrate competence based tasks**
   Add activities that promote critical thinking, problem solving, communication, and creativity, fully aligning with the curriculum.
3. **Increase authentic and meaningful tasks**
   Incorporate texts and exercises that connect to real life situations, student interests, and daily communication contexts.
4. **Strengthen support for differentiated instruction**
   Provide tasks of varying difficulty, including support materials for students with learning difficulties, to help teachers individualize learning.
5. **Encourage interactive and collaborative learning**
   Include more pair work, group work, and project based tasks that enhance cooperation and active participation.
6. **Improve clarity and consistency in structure**
   Ensure coherence between learning objectives, activities, and evaluation tools so teachers can more easily plan lessons.
7. **Develop supplementary digital materials**
   Provide online resources such as audio files, interactive exercises, and videos to enrich the learning experience and support diverse learning styles.

Ethical Statement: In this study, we declare that the rules outlined in the *"Higher Education Institutions Scientific Research and Publication Ethics Directive"* have been fully respected and that none of the actions listed under *"Actions Against Scientific Research and Publication Ethics"* have been carried

out. We also declare that there is no conflict of interest among the authors, that all authors have contributed to the study, and that full responsibility for any ethical violations lies with the authors of the article.

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Data Availability Statement: The data from this study are not publicly available, as they were collected anonymously through online platforms, and the authors have committed to keeping them strictly confidential; therefore, their disclosure may compromise participants' trust. Additionally, we consider that the data, if published in full, may be misused or employed as ready made material for other studies without the appropriate scientific context, potentially compromising the accuracy and integrity of the original analysis. For these reasons, the data can only be provided in summarized form and solely upon a well justified request from other researchers, ensuring full adherence to ethical standards and research integrity.

Generative Artificial Intelligence Use Statement: Generative artificial intelligence tools (ChatGPT) were used in this study for the purpose of identifying recent studies related to the topic. All analyses, interpretations, and the final preparation of the content were carried out by the authors, who bear full responsibility for the accuracy and integrity of the presented material. The manuscript does not contain text generated directly by artificial intelligence without author involvement.

Conflict of Interest: There is no financial, personal, or institutional conflict of interest that could have influenced this study.

Institutional Review Board Statement: This study did not require ethical approval from any committee, as the data were collected anonymously and voluntarily through online platforms, without including any personally identifiable information. All research procedures were conducted in accordance with general ethical standards for scientific research.

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Examining the Stress and Social Support Perceived by Parents of Children With Special Needs*

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Abstract

Every child is eagerly awaited by their parents, and during this process, various expectations arise within the family regarding the child to be born. If the child joining the family has special needs, this can cause the family's expectations to change and lead to intense anxiety and stress. Children with special needs are provided with special education services to enable them to live as independent individuals in society and meet their needs independently. Although some of them benefit from this service, many of them cannot act completely independently due to their disability. At this point, it is believed that the biggest supporters of these individuals are their parents. While parents strive to provide their children with all kinds of support during this process, parents of children with disabilities also face various difficulties in terms of their children's care, education, treatment, and upbringing. This study aims to examine the stress and social support levels perceived by parents of children with special needs in terms of various variables. The research sample consisted of 289 parents of children with special needs aged 6-18. The data collection tools used in the study were the "Perceived Stress Scale," the "Multidimensional Perceived Social Support Scale," and the "Demographic Information Form." The data obtained in the study were evaluated using the independent sample t-test and one-way analysis of variance (ANOVA). The results of the study revealed that the monthly income of parents of children with special needs affected their perceived stress and perceived social support. No significant differences were found based on the child's educational status or whether the parent was the mother or father.was no significant difference according to the child's education level, mother's or father's status.

Keywords: parents with children with special needs, perceived stress, perceived social support

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Introduction

The birth of an individual with a disability can cause various problems in the family (Özgüven, 2000). Difficulties related to having a child with special needs include child care, financial problems, hospital expenses, reduced income due to one of the spouses leaving the job, and behavioral problems of the child (Allen, Ciambrone & Welch, 2000). When the level of the child's disability increases, the child may need lifelong care, and the child's care and treatment problems further exhaust the family (Sarı & Altıparmak, 2008). In addition to these, decreased social support, decreased family satisfaction, emotional problems, changes in lifestyle, and increased responsibilities of parents can lead to stress and depression (Ohaeri, 2003). When we look at the literature, there is information that parents with mentally or physically disabled children are under stress and even mothers are under stress more than fathers. The ability of parents to cope with these and similar problems is related to the social support they receive. It is a great support for the family to feel that they are not alone and to believe that they have a friend who will support them. The support that families need can come from the family circle, friends and relatives, or even psychologists (Akkök, 2003). When we look at the studies conducted with the parents of individuals with disabilities, social support supports harmony within the family, and as the level of social support increases, psychological problems in family members decrease. In addition, as the social support provided to the family increases, the level of hopelessness and anxiety decreases (Darbyshire & Stenfert Kroese, 2012; Weiss, 2002).

When we look at the literature, there are various studies examining the stress levels and social support perceptions of individuals with special needs Cuzzoonea et al., (2016) compared perceived parental stress, coping strategies and social support in families of children with low-functioning autism spectrum disorder, high-functioning autism spectrum disorder, Down syndrome and children with normal development; Çan Aslan (2010) and Sivrikaya & Tekinarslan (2013), Köksal & Kabasakal (2012) compared the factors predicting stress, psychological symptoms, perceptions of social support and coping styles of parents with children with intellectual disabilities; Dragomyretska vd. (2020) examined the relationship between social support perceptions and stress levels of parents of children with autism spectrum disorder; Dyson (1997) examined the relationship between parental stress, family functioning and social support levels of parents of children with developmental delay; Felizardo et al. (2016) examined the impact of parents' adaptation to disability, stress indicators and social support; Kaner & Bayraklı (2009) examined resilience, social support and stress coping skills in mothers with and without intellectual disabilities; Robinson & Weiss (2020) and Sencar (2007) examined the relationship between perceived social support and stress levels of parents with autistic children; Skok et al. (2006) examined the relationship between perceived social support, stress and well-being levels of mothers of individuals with cerebral palsy; Zhao et al. (2021) examined the mediating role of social support in the relationship between parenting stress and resilience of parents of disabled children. Savari et al. (2021) found a negative and significant relationship between perceived stress and quality of life of parents of children with special needs, as well as a positive and significant relationship between social support and resilience of parents and quality of life.

In Turkey, there is a limited number of studies examining the stress and social support levels perceived by parents of children with ASD, DD, CP and Down Syndrome in terms of various variables. Therefore, this study is important in order to fill this gap. In addition, in the light of this information, it is important in terms of guiding the organization of training and support services that can be provided to parents in order to reduce their stress and thus increase their social support.

In addition, this study is considered to be important in terms of providing data for future studies to be conducted with parents of children with intellectual disability, Down syndrome, autism and cerebral palsy. For the aforementioned reasons, this study aimed to examine the level of stress and social support perceived by parents of children with special needs in terms of various variables. For this purpose, the following question was sought to be answered.

1.How do the Perceived Stress Scale score and Perceived Social Support score change according to whether the parents participating in the study are mothers or fathers, according to the child's education level, and according to the monthly income of the parents?

Method

The research model, In this section, the research model, participants, data collection tools, data collection and data analysis will be discussed.

Research Model: In this study, a relational research model was used and it is a descriptive research. Relational research is a non-experimental research study designed to explain whether there is a relationship between two or more variables and what kind of relationship it is and to make predictions about the variables (Christensen, Johnson & Turner, 2010).

Population and Sample: In this study, which was conducted to examine the relationship between the perceived stress and social support levels of parents with children with special needs, the population of the study consisted of parents with children with special needs between the ages of 6-18, who were studying in special education schools affiliated to the Directorates of National Education of the Central District of Edirne province in the spring semester of the 2023-2024 academic year.

The sample of this study consisted of 298 parents of children with special needs selected by purposive sampling. The criteria for inclusion in the sample were that families of children diagnosed with intellectual disability, Down syndrome, Cerebral Palsy and Autism Spectrum Disorder were included in the study and other disability groups were excluded from the study. Another selection criterion was that the ages of the children of the families included in the sample should be between 6-18 years old. Before conducting the data analysis, 9 people were excluded from the data set due to various reasons (missing information, etc.), and a total of 289 people were reached.

Necessary permissions were obtained from Edirne Provincial Directorate of National Education to conduct the study. In this context, the researcher visited public and private special education schools affiliated to the Ministry of National Education and made the necessary explanations about the questionnaire to the parents of children with special needs, and the participation of volunteer parents in the study was ensured.

Before data collection in this study, the sample size was determined with the G*Power 3.1.9.7 program with reference to the research conducted by Sivrikaya and Tekinarslan (2013). In the program, the effect size F value d=0.45 found by Sivrikaya and Tekinarslan (2013) was taken as basis, and 95% confidence level and α= 0.05 were accepted. Accordingly, the G*power program suggested that 250 parents with children with special needs is a sufficient number for the research sample (Akbulut, 2021; Özçomak & Çebi, 2017). Accordingly, it can be said that the sample size of this study is at an acceptable level for this study.

When the frequency values of the demographic information of the participants are analyzed, it is seen that 22.5% of the participants are fathers and 77.5% are mothers. When the type of special needs of the children of the parents with children with special needs included in the research is examined; 36.7% of them have ASD, 32.9% have Mild-Moderate-Heavy Intellectual Disability, 18.3% have Cereblal Palsy, 12.1% have Down Syndrome. Of the participants included in the study, 14.5% defined their monthly income as minimum wage, 28% as below minimum wage, and 42.9% as above minimum wage. The educational status of participants' children is 30.1% preschool graduates, 45.7% elementary school graduates, 14.9% middle school graduates, and 8.7% high school graduates.

Data Collection Tools: Demographic information form, perceived stress scale and multidimensional perceived social support scale were used to collect the research data.

Demographic Information Form: The demographic information form developed by the researcher includes questions about the gender, age, educational level, economic level, number of children, number of children with special needs, gender of the child with special needs, disability group of the child and family type.

Perceived Stress Scale: The Perceived Stress Scale was developed by Cohen, Kamarck and Mermelstein (1983) and adapted into Turkish by Eskin et al. (2013). The scale consists of 14 items and is 5-point Likert type. Seven items of the scale are reverse scored. The Perceived Stress Scale has two factors. These factors are perception of inadequate self-efficacy and perception of stress/discomfort. The internal consistency coefficient of the scale was 0.84 and the test-retest reliability was 0.87.

Multidimensional Perceived Social Support Scale: The scale developed by Zimmet et al. (1988) was adapted into Turkish by Eker and Arkar (1995). The scale has 12 items and is a 7-point Likert-type scale. The scale consists of three sub-factors. These factors are family, friends and a special person. Cronbach's alpha method was used to measure internal consistency. Cronbach's alpha of the scale was observed between 0.80 and 0.95.

Data Analysis: In this study, which was conducted to examine the perceived stress and social support levels of parents of children with special needs in terms of various variables, the data collected with the "Perceived Stress Scale" and "Multidimensional Perceived Social Support Scale" were analyzed with the SPSS-26.0 package program. After the research data were obtained, normality analysis was performed on the data related to the variables, and the normality distribution of the data, kurtosis skewness values and diagrams were examined. It was observed that the data showed normal distribution. Hair et al. (2010) and Bryne (2010) stated that if the skewness value is within ± 2 and kurtosis value is within ± 7, the data shows normal distribution.

For this reason, independent sample t-test and one-way analysis of variance (ANOVA) were used in the study. One-way Analysis of Variance (ANOVA) was also conducted to determine the difference between the variables in the study. When a significant difference was found in these analyzes, Post Hoc LSD test was used to determine the source of the difference. The eta-squared (eta-squared-η2) effect size was taken into consideration for the significant difference (Cohen, 1992). When evaluating the effect size, the range of .000 and .003 was interpreted as no effect size, .010 and .039 as a weak effect size, .060 and .110 as a moderate effect size, and .140 and .200 as a strong effect size (Cohen, 1988).

Findings

Table 1.
Independent Sample T-Test On Perceived Stress Scale Score According to the Parent Variable Participating ın the Study

	Parent Status	N	X	ss	t	sd	p
Perceived Stress Total	Father	65	2,7308	,79677	-1,220	83,012	,226
	Mother						
Perception of Inadequacy Self-Efficacy	Father	65	2,6110	,93627	-1,663	87,589	,100
	Mother	224	2,8203	,72707			
Discomfort	Father	65	2,8505	,78872	-,457	84,059	,649
	Mother	224	2,8985	,56532			

*p<.05, **p<.01

As seen in Table 1, the results of the independent sample t-test regarding the Perceived Stress Scale score according to whether the parents participating in the study were mothers or fathers were examined; It was determined that there was no statistically significant difference in the Perceived Stress Scale (t(83,012)=-1,220 p=,226), Perceived Stress Disability Self-Efficacy Perception subscale (t(87,589)=-1,663 p=,100), Perceived Stress Discomfort subscale (t(84,059)=-,457 p=,649) scores according to whether the participants were mothers or fathers. It was determined that there was no significant difference in the stress levels of the parents with children with special needs participating in the study according to their status of being a mother or father.

Table 2.

Independent Samples T-Test For Perceived Social Support Scale Scores According to the Parent Variable Participating ın the Study

	Parent Status	n	x	ss	t	sd	p
Perceived Social Support Scale Total	Father	65	4,80	1,783	1,497	287	,135
	Mother	224	4,43	1,755			
A Special Person	Father	65	4,56	2,092	1,658	287	,098
	Mother	224	4,09	1,998			
Friend	Father	65	4,68	1,917	,835	287	,405
	Mother	224	4,46	1,869			
Family	Father	65	5,16	1,630	1,659	287	,098
	Mother	224	4,74	1,868			

*p<.05, **p<.01

As seen in Table 2, the results of the independent sample t-test regarding the Perceived Social Support Scale score according to whether the parents participating in the study were mothers or fathers were examined; It was determined that there was no statistically significant difference in the Perceived Social Support Scale (t(287)=1,497 p=,135), Perceived Social Support A Special Person subscale (t(287)=1,658 p=,098), Perceived Social Support Scale Friends subscale (t(287)=,835 p=,405), Perceived Social Support Scale Family subscale (t(287)=1,659 p=,098) scores according to the participants' mother or father status. In other words, it was determined that there was no significant difference in the perceived social support levels of the parents with children with special needs who participated in the study according to the status of being a mother or father.

Table 3.

Anova Results Regarding The Perceived Stress Scale Score Of The Parents Participating ın the Study According to the Educational Status Of The Child With Special Needs

		n	x	ss	F	p
Perceived Stress Total	Pre-school	87	2,79	,716	,780	,506
	Elementary school	132	2,7959	,59879		
	Middle school	43	2,9032	,51258		
	High school	25	2,9569	,51756		
	Total	287	2,8252	,61875		
Perception of Inadequacy Self-Efficacy	Pre-school	87	2,7280	,86941	,991	,397
	Elementary school	132	2,72727	,75144		
	Middle school	43	2,8743	,73005		
	High school	25	2,9600	,69805		
	Total	287	2,7677	,78195		
Discomfort	Pre-school	87	2,8571	,70459	,207	,891
	Elementary school	131	2,8744	,62923		

	Middle school	43	2,9158	,50884
	High school	25	2,9543	,41796
	Total	286	2,8824	,61977

*p<.05, **p<.01

According to Table 3, it was determined that there was no statistically significant difference in Perceived Stress Scale total score (F(3-283)=,780 p=,506), Perceived Stress Disability Self-Efficacy Perception sub-dimension score (F(3-283)=,991 p=,397) and Perceived Stress Discomfort sub-dimension score (F(3-283)=,207 p=,891) according to the education level of the child with special needs. Accordingly, it was determined that there was no significant difference in the stress perceptions of the parents with children with special needs who participated in the study according to the education level of the child with special needs.

Table 4.

Anova Result Regarding The Perceived Social Support Scale Score Of The Parents Participating ın the Study According to the Educational Status of the Child with Special Needs

		n	x	ss		p
Perceived Social Support Scale Total	Pre-school	87	4,5093	1,87577	,314	,815
	Elementary school	132	4,5961	1,79612		
	Middle school	43	4,3162	1,66677		
	High school	25	4,3876	1,43457		
	Total	287	4,5097	1,76826		
A Special Person	Pre-school	87	4,2443	2,06929	,264	,851
	Elementary school	132	4,2468	2,10598		
	Middle school	43	4,0058	1,79076		
	High school	25	3,9767	1,90478		
	Total	287	4,1864	2,02631		
Friend	Pre-school	87	4,4243	2,04818	,233	,873
	Elementary school	132	4,6149	1,83785		
	Middle school	43	4,4186	1,87379		
	High school	25	4,4700	1,49185		
	Total	287	4,5151	1,87607		
Family	Pre-school	87	4,8602	1,90227	,582	,627
	Elementary school	132	4,9318	1,85560		
	Middle school	43	4,5233	1,86590		
	High school	25	4,7100	1,30440		
	Total	287	4,8296	1,82751		

*p<.05, **p<.01,

According to Table 4, it was determined that there was no statistically significant difference in the Perceived Social Support Scale total score (F(3-283)=,314 p=,815), the Perceived Social Support Scale Special Person sub-dimension score (F(3-283)=,264 p=,851), the Perceived Social Support Scale Friend sub-dimension score (F(3-283)=,233 p=,873) and the Perceived Social Support Scale Family sub-dimension score (F(3-283)=,582 p=,627) according to the educational status of the child with special needs. It was determined that there was no significant difference in the social support perceptions of the parents of children with special needs who participated in the study according to the educational status of the child with special needs.

Table 5.

Anova Result Regarding The Perceived Stress Scale Score According to the Monthly İncome of the Parents Participating ın the Study

		N	$\bar{X}$	ss	F	p	η2	Farkın kaynağı (LSD Sonucu)
Perceived Stress Total	Minimum wage	42	2,9773	,56732	2,845	,060		
	Below minimum	81	2,9050	,61419				
	Above minumum	124	2,7475	,64315				
	Total	247	2,8382	,62561				
Perception of Inadequacy Self-Efficacy	Minimum wage	42	2,9769	,83297	1,769	,173		
	Below minimum	81	2,7898	,76007				
	Above minumum	124	2,7155	,77257				
	Total	247	2,7843	,78145				
Discomfort	Minimum wage	41	3,0035	,44204	4,283	,015*	,009	2>3
	Below minimum	81	3,0148	,64500				1>3
	Above minumum	124	2,7801	,64991				
	Total	246	2,8946	,62704				

*p<.05, **p<.01

1=Below wage, 2=Minimum wage, 3=Above wage

According to Table 5, it was determined that there was no statistically significant difference in the Perceived Stress Scale total score (F(2-244)=2.845 p=.060) and the Perceived Stress Inadequacy Self-Efficacy sub-dimension score (F(2-244)=1.769 p=.173) according to the monthly income of the parents participating in the study, but there was a statistically significant difference in the Perceived Stress Discomfort sub-dimension score (F(2-244)=4.283 η2=.009; p=.015). In other words, it was found that there was a significant difference in the perceived stress of the parents of a child with special needs participating in the study and the salary status being lower, middle or upper minimum wage. According to the Post Hoc LSD test conducted for the source of the difference, it was determined that the perceived stress discomfort score of the parents of a child with special needs earning minimum wage was higher than the parents earning above minimum wage. It was found that the perceived stress discomfort score of parents of children with special needs who earn below the minimum wage is higher than that of parents who earn above the minimum wage.

Table 6.

Anova Result Regarding The Perceived Social Support Scale Score According to the Monthly Income of the Parents Participating ın the Study

		N	$\bar{X}$	ss	F	P	η2	Farkın kaynağı (LSD Sonucu)
Perceived Social Support Scale Total	Minimum wage	42	3.8333	2,82862	5,246	,006**	,04	3>1
	Below minimum	81	4,4118	1,70963				
	Above minumum	124	4,8247	1,75633				
	Total	247	4,5207	1,78363				
A Special Person	Minimum wage	42	3,5060	1,91312	4,317	,014*	,034	3>1
	Below minimum	81	4,0391	2,00555				
	Above minumum	124	4,5168	2,03587				
	Total	247	4,1883	2,03264				
Friend	Minimum wage	42	3,7341	1,99221				
	Below minimum	81	4,3663	1,88109	6,272	,002**	,49	3>1
	Above minumum	124	4,8696	1,78174				
	Total	247	4,5115	1,89058				
Family	Minimum wage	42	4,2560	1,92345	3,524	,031*	,028	3>1
	Below minimum	81	4,8282	1,69632				
	Above minumum	124	5,0968	1,78497				
	Total	247	4,8657	1,79897				

*p<.05, **p<.01

1=Minimum wage, 2=Below minimum, 3= Above minimum

According to Table 6, it was determined that the Perceived Social Support Scale total score (F(2-244)=5.246 η2=.04; p=.006), the Perceived Social Support Scale A Special Person sub-dimension score (F(2-244)=4.317 η2=.034; p=.014), the Perceived Social Support Scale Friend sub-dimension score (F(2-244)=6.272 η2=.49; p=.002) and the Perceived Social Support Scale Family sub-dimension score (F(2-244)=3.524 η2=.028; p=.031) were significantly different according to the monthly income of the parents who participated in the study. According to the Post Hoc LSD test conducted for the source of the difference, it was found that there was a significant difference in the perceived social support of the parents of a child with special needs who participated in the study and their salary status being lower, middle or upper minimum wage. Accordingly, it was determined that the perceived social support of parents of children with special needs who earn above minimum wage was higher than the perceived social support of parents who earn below minimum wage. It has been found that the perceived social support special person subdimension score of parents earning above minimum salary and having a special needs child is higher than the perceived social support special person subdimension score of parents earning below minimum salary. It has been found that the perceived social support friend subdimension score of parents earning above minimum salary and having a special needs child is higher

than the perceived social support friend subdimension score of parents earning below minimum salary. It has been found that the perceived social support family subdimension score of parents earning above minimum salary and having a special needs child is higher than the perceived social support family subdimension score of parents earning below minimum salary.

Discussion, Conclusion, and Suggestions

This study aimed to examine the perceived stress and social support levels of parents of children with special needs in terms of various variables. According to the results of the study, it was determined that there was no significant difference in the stress levels of parents of children with special needs according to whether they were mothers or fathers. When we look at the literature, findings parallel to these research results were found. Studies on the stress levels of parents of children with special needs according to their parenting status (Baker-Ericzen et al., 2005; Dereli & Okur, 2008; Kaner, 2004; Kurşun, 2018; Park et al., 2012; Şanlı, 2017; Wanamaker & Glenwick, 1998) also confirm this phenomenon. On the other hand, Aptoul Chalim (2022) and Güzeloğlu (2019) stated in their research that the stress level of mothers of children with special needs is significantly higher than the stress level of fathers. In fact, Dabrowska & Pisula (2010), Herring et al. (2006) and Avcı, Taşci & Mutlu (2021) reported that the stress levels of mothers of children with ASD are higher than the stress levels of fathers. According to the results of this research, the reason for the lack of differences in stress levels between parents may be due to the fact that they live in the same house and share the responsibility of the child equally. The results of the research found that there was no statistically significant difference in the perceived social support levels of parents of children with special needs based on whether they were mothers or fathers. Studies (Aysever & Demirok 2019; Çan Aslan, 2010; Bilgin, 2012; Çattık, 2015; Hall, 2012; Kaner, 2004; Karpat & Girli, 2012; Kaymakçı, et al., 2022; Kırbaş & Özkan, 2013) also overlap with this phenomenon. On the other hand, Kahriman & Bayat (2008) determined that mothers perceive less social support than fathers. According to the results of this research, the reason why there is no significant relationship between the parents' parenting status and the parents' social support levels can be attributed to the parents taking equal responsibilities at home. Since they take equal responsibilities, the burden on the mother and father at home will be equal. This will affect their perception of social support equally.

According to the results of the research, it was determined that there was no significant difference in the stress perceptions of parents with children with special needs who participated in the study according to the educational status of the child with special needs. When we look at the literature, findings parallel to the results of this research were found. The research results of Gökmenoğlu (2021) and Sencar (2007) also confirm this phenomenon. On the other hand, Kaner (2004) found that parents' perceived stress regarding the child's functions experienced more stress in parents of children with special needs in the preschool period compared to parents of children in middle childhood and adolescence. According to the results of this research, the reason why no significant relationship was observed between the child's education level and the parents' stress level may be due to the fact that different variables (such as income level) affect the parents' stress. According to the results of the research, it was determined that there was no significant difference in the perception of social support of parents with children with special needs participating in the study according to the educational status of the child with special needs.

According to the research results, it was found that there was a significant difference in the perceived stress of the parents of a child with special needs participating in the study and their salary status, whether it was lower, middle or upper minimum wage. Accordingly, it has been determined that parents of children with special needs who earn below minimum wage are more stressed than parents of children with special needs who earn above minimum wage. It has been found that parents of children with special needs who earn minimum wage perceive more intense stress than parents of children with special needs who earn above minimum wage. When we look at the literature, we find findings parallel to the results of this research. Studies (Coşkun & Akkaş, 2009; Çakır, 2009; Doğru & Arslan, 2008; Gutman, 2008; İlhan, 2014; Upadhyaya & Havalappanavar, 2008) also confirm this phenomenon by finding that as the income level of parents increases, the stress level decreases, and as the income level decreases, the anxiety level increases. On the other hand, Ayyıldız et al. (2012), Aptoul Chalim (2022) and Güzeloğlu (2019) found in their studies that there was no relationship between the perceived stress of parents of children with special needs and their income status. According to the research results, it was

found that there was a significant difference in the perceived social support of the parents of a child with special needs participating in the study and their salary status being lower, middle or upper minimum wage. Accordingly, it was determined that the perceived social support of parents of children with special needs who earn above minimum wage was higher than the perceived social support of parents who earn below minimum wage. Studies (Bromley et al., 2004; Dalgard, 2009; Deveci & Ahmetoğlu, 2018; Kaymakçı, et al., 2022; Kurtbeyoğlu & Demirtaş, 2020; Yersel & Durualp, 2019) also coincide with this phenomenon. According to the results of this research, the reason why a significant relationship is observed between the income level of parents and the social support levels of parents is that, according to Hoffman, Turnbull et al., (2006), when a person's financial income is high, she will create better opportunities for the care and education of both herself and her family. This will ensure that even parents find good support.

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Ethics statement: This study complies with the rules specified in the "Higher Education Institutions Scientific Research and Publication Ethics Guidelines." No actions contrary to Scientific Research and Publication Ethics have been taken. In this regard;

Research permission was obtained from the Trakya University Social and Human Sciences Research Ethics Committee in order to conduct the research.

Research permission was obtained from the Edirne National Education Directorate to conduct the research.

The necessary permissions were obtained from the researchers for the use of the scales.

The principle of voluntariness was taken into account, and parents who did not wish to participate in the study were not included.

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6th Grade Students' Views on Values: Intervalue Kindness

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Abstract

From the past to the present, kindness is an important trait that reflects a person's character. In order to continue the process of existence, it aims to help individuals internalise values and move beyond discourse to behavioural dimensions and social relations. This behaviour contributes to the establishment of healthy relationships between individuals and helps to maintain social order. Kindness plays a very important role in ensuring that social relationships continue in a healthy manner. It enables people to communicate with each other in a more harmonious and respectful way. The concept of values has emerged as one of the most popular concepts in recent years. Given the emphasis placed on values in our time, it would be hasty and superficial to conclude that this reflects how much importance is attached to them or how far we have progressed in this regard. The current emphasis on values can be interpreted not as an increase in the value placed on them, but rather as an increase in the need for them. In this context, this study aims to obtain the opinions of 6th grade middle school students on the value of kindness, which is one of our values and is considered to be a positive trait that connects values. In line with this aim, the problem statement 'What are the opinions of 6th grade students on values?' was studied using the case study method, which is a qualitative research model. The study group consisted of sixty-six 6th grade students from a private school in Edirne. The research data were collected using the 'Our Values Interview Form' developed by the researchers. The results show that very few of the students in the study group expressed views that accurately reflected values education. While they stated that the values that enhance friendships are 'respect' and 'honesty,' they indicated that the values that undermine friendships are 'lying,' 'being rude,' 'swearing,' and 'fighting.'

Keywords: Value, values education, kindness

Introduction

Values influence people's behavior patterns and play an important role in determining attitudes and behaviors. It is difficult to evaluate and comment on individuals' important issues and the values they embrace without taking these values into account. By learning about the values of individuals and various cultures, their attitudes and behaviors can be predicted to a large extent. Human values add dignity to life. They multiply the beautiful aspects of life, such as kindness, honesty, tolerance, goodness, and compassion.

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Among values, "kindness" is an important concept that preserves its essence like a pearl. In Turkish, it is a word that expresses respectful, polite, and refined behavior in human relationships. Kindness encompasses being understanding and tolerant towards others, communicating appropriately, and behaving politely. It encompasses acting in accordance with social norms and etiquette in society.

Kindness is also an important trait that reflects a person's character. This behavior contributes to the establishment of healthy relationships between individuals and helps maintain social order.

Kindness plays an important role in building trust between people. A polite and respectful attitude makes the other person feel valued and respected. This strengthens the relationship of trust. It draws people together. People prefer kind and understanding individuals. This enables the establishment of healthier and more positive relationships and helps resolve disputes and disagreements constructively.

Kindness is not an innate trait; it is a value that can be acquired through education. That is why children should be introduced to kindness, and this value should be instilled in them. The importance of kindness should be explained at home, at school, and in society, and this value should be transformed into behavior in daily life. Kindness education in schools is an important tool that will enable children to empathize, respect others, and gain social skills.

The purpose of this research is to gather the opinions of 6th grade middle school students on the value of kindness, which is one of our values and is considered to be a positive trait that connects values. Based on this, the problem is defined as follows: What are the opinions of 6th grade students on values?

Based on this problem statement, the following sub-problems were formulated.

1- How do 6th grade students express values education?

2- What values do 6th grade students consider important?

3- According to 6th grade students, which value fosters friendships at school?

4- According to 6th grade students, what situation disrupts friendships at school?

5- How do 6th grade students express the value of kindness?

6- What situations do 6th grade students consider to be disruptive to kindness

Literature Review

The concept of values has emerged as one of the most popular concepts in recent years. Considering how much emphasis is placed on values in our era, it would be hasty and superficial to conclude that we have reached an advanced stage in this regard. The emphasis placed on values today can actually be interpreted not as an increase in the value given to values, but as an increase in the need for values. (Arslan and Yaşar, 2007: 10-11).

Interpersonal relationships involve personal values such as love, honesty, loyalty, respect, fairness, open-mindedness, and the ability to establish controls, whether directly or indirectly. (Kuçuradi. 1995: 58). All of these lead to harmonious living: Human values are the pillars of life. Human values and moral values are overlapping concepts. Morality is the totality of good and bad behaviors and the behaviors and rules that people are responsible for adhering to (Kulaksızoğlu, 1997: 86). Which behaviors are good or bad varies from person to person. Just as whether behaviors are good or bad varies from person to person, it also varies from society to society, and opinions differ on what constitutes good and bad. One of the goals of education and school is to raise people with good morals. This is directly related to the values that individuals possess (Kaya, 1997: 185). However, values education has not been given the necessary place and importance in either general education or social studies education to date (Akbaba and Altun 2003; Tolunay, 2017).

Method

The method of this research is a qualitative research model called a case study, also known as an example study. This is because a current phenomenon has been studied within the context of real life. It is necessary to understand everything related to humans and human behavior in a multifaceted way within the environment in which it occurs. For this reason, qualitative research provides depth in terms of

focusing on the investigation of phenomena, situations, and behaviors (Şimşek and Yıldırım, 2006). Furthermore, case studies are used to identify and observe the details that constitute an event, develop possible explanations for an event, and evaluate an event (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, and Demirel, 2011).

Study Group

The study group for this research consists of 6th grade students from our school, Özel Edirne Bahçeşehir Middle School. All participating students voluntarily expressed their opinions, and no student was pressured to express their opinion. The demographic characteristics of the students who voluntarily participated are as follows:

Table 1.

Distribution of Students in the Study Group by Gender

Gender	6A		6B		6C		Total	
	n	%	n	%	n	%	n	%
Female	11	52	9	39	11	50	31	47
Male	10	48	14	61	11	50	35	53
Total	21	100	23	100	22	100	66	100

Table 1 shows the genders of the students who made up the study group. According to this, 47% of the study group, which consisted entirely of 6th graders, were female students, while 53% were male students, and a total of 66 students were interviewed.

Data Collection Tool

A structured interview form called the "Our Values Interview Form" was prepared by the researchers to collect research data. The form, consisting of demographic characteristics and 6 open-ended questions, was created by the researchers themselves after conducting a literature review and examining sample forms. After the form was created, it was reviewed by a Social Studies Teacher, a Guidance Counselor, a Religious Culture Teacher, and three academics working in the faculty of education, and expert opinions were obtained. The form was then revised according to the suggestions received. The revised form was administered to three sixth-grade students attending another school, as suggested by the academic experts, to test whether the questions were understandable. No problems were identified at the end of the administration, and since there were no negative comments regarding the comprehensibility of the form, it was deemed suitable for use. Permission was obtained from our school administration prior to the administration.

Data Analysis

The data was collected between December 17, 2024, and December 19, 2024, during the lunch breaks of sixth-grade students who volunteered to participate during school hours.

Content analysis was performed on the data obtained from the responses to the open-ended questions in the interview forms. Content analysis allows for in-depth examination of qualitative data and leads to meaningful results (Yıldırım & Şimşek, 2006). Accordingly, the students' responses were carefully read and coded. Frequencies were created based on the similarities or differences in the codes. The data were read and coded by both researchers together and tabulated (Miles & Huberman, 1994). . The agreement rate between the two researchers was 100%. To make the findings more explanatory, excerpts from student responses were also included below the tables.

Findings

The data for this study were collected using the "Our Values Interview Form" prepared by the researchers and administered to the study group to obtain written opinions. Answers to the six sub-problems were sought from the findings obtained from this form.

The first sub-problem of the research was formulated as "How do 6th grade students express values education?" The findings related to this sub-problem are presented in Table 2 below.

Table 2.

Students' Expressions of Values Education

Opinions		**F**	**%**
Opinions expressing values education	Respect for people	4	22
	Being polite/acting courteously	2	
	People valuing each other	2	
	Being polite	1	
	Maintaining good friendships	1	
	Education in ethical behavior	1	
	Important values	1	
	Raising sensitive individuals	1	
	Sharing	1	
Views that do not express values education	Higher education	1	13
	Earning a bachelor's degree	1	
	Quality education	1	
	Safe education	1	
	Understanding the lessons	1	
	Having fun in class	1	
	Studying	1	
	Evaluating education on a subject	1	
	Misbehavior	1	
	The importance of education	1	
	Valuing education	1	
	Rule	1	
	Teacher	1	
No Idea		43	55
Statements questioning the accuracy of their knowledge		8	10
Total		78	100

Looking at Table 2, only 22% of the students in the study group reflected views that correctly expressed values education. Among these views, respect for people, being polite, valuing each other, etc. stand out. Students expressed views such as "Values education is the values that people care about in their daily lives" and "Values education is friends being kind to each other." 13% of the students reflected views that did not express values education. The views expressed by students such as "I think it is something like valuable education or getting a degree" and "I think values education could be an assessment of our education on a subject" were considered views that did not express values education.55% of the students had no idea what values education meant. These students wrote their opinions as "I don't know." 10% of the students were unsure about the accuracy of their knowledge. "Isn't it education? Is it something related to education?" "Isn't good education a beneficial thing?", "Is

it teaching different values as part of education?", "Is it education where we learn values?", "Is it something related to giving value to someone?"

The second sub-problem of the research was formulated as "What are the values that 6th grade students care about?" The findings related to this sub-problem are presented in Table 3 below.

Table 3.

Values Students Value

Values Students Value	**f**	
Respect	16	15
Honesty	15	14
Kindness	12	12
Friendship	11	11
Solidarity, sharing	6	6
Kindness	5	5
Love	4	4
Doing good	4	4
Trust	3	3
Kindness	2	2
Being fair	2	2
No response	12	12
Responses that do not express value	11	11
Total	103	100

Looking at Table 3, it is seen that the students who participated in the study value many of the values listed at . Among these values, "Respect" stands out at 15%, "Honesty" at 14%, and "Kindness" at 12%. However, 12% of students responded to this sub-problem by writing "I don't know" or leaving it blank. Similarly, 11% of students wrote concepts such as class, games, study time, cards, playtime, health, academic and athletic success, friends, ambition, empathy, being cheerful, etc., without being sure of their accuracy. These were also considered responses that did not express a value.

The third sub-problem of the study was formulated as "According to 6th grade students, which value develops friendships at school?" The findings related to this sub-problem are presented in Table 4 below.

Table 4.

Value That Enhances Friendship Relationships

Values That Foster Friendship Relationships in School	**f**	
Honesty	19	16
Respect	18	16
Kindness	12	10
Cooperation	11	9
Trust	10	9
Love	7	6
Sharing	3	3
Friendship	2	2
Responses that do not express value	34	29

Total	116	100

Looking at Table 4, it is seen that the values most frequently mentioned by the students participating in the study as values that develop friendships are "Honesty" and "Respect" at a rate of 16% ( ). These values are followed by "Kindness" at 10%. "Cooperation," "Trust," "Love," "Sharing," and "Friendship" are other expressions they believe develop friendships. 29% of students gave answers that did not express any value. These responses include, for example: communicating to reach an agreement, forming groups in class for homework, establishing good relationships, getting along well, behaving well, playing games together, chatting, being positive, getting to know each other better, doing homework together, getting along well, socializing, meeting outside of school, joking around, empathy, spending time together, good behavior, equality...

The fourth sub-problem of the research was formulated as "According to 6th grade students, which of the following situations disrupt friendship relationships at school?" The findings related to this sub-problem are presented in Table 5 below.

Table 5.

Situations That Destroy Friendships at School

Situations That Destroy Friendships at School	***f***	***%***
Lying	*21*	*18*
Don't be rude, don't swear	*19*	*16*
Fighting	*11*	*9*
Disrespect	*7*	*6*
Gossiping	*7*	*6*
Selfishness	*6*	*5*
Exclusion	*5*	*5*
Betrayal/Unreliability	*5*	*5*
Bullying	*4*	*4*
Jealousy	*4*	*4*
Lack of empathy	*4*	*4*
Mocking	*3*	*3*
Resentment	*3*	*3*
To strike	*3*	*3*
Discrimination	*2*	*2*
Speaking without thinking	*2*	*2*
Slander	*2*	*2*
Cheating	*1*	*1*
Hate	*1*	*1*
Pride	*1*	*1*
Total	*111*	*100*

Looking at Table 5 , the students who participated in the study stated that the situations that most disrupted their friendships at school were "lying" (18%), "being rude, swearing" (16%), and "fighting" (9%). These situations are followed by disrespect, gossiping, selfishness, exclusion, betrayal/untrustworthiness, bullying, jealousy, lack of empathy, mocking, sulking, hitting, discrimination, speaking without thinking, slander, cheating, hatred, and arrogance.

The fifth sub-problem of the study was formulated as "How do 6th grade students express the value of kindness ?" The findings related to this sub-problem are presented in Table 6 below.

Table 6.

Student Opinions on the Value of Kindness

Student Opinions on the Value of Kindness	**f**	
Respectful behavior	23	24
Being polite, kindness	19	20
Being kind	18	18
Being tolerant	8	8
Love	6	6
Honesty, reliability	6	6
Helping	5	5
Follow etiquette	3	3
Being compassionate	2	2
Sharing	1	1
Empathy	1	1
Virtuous behavior	1	1
Not lying	1	1
Equality	1	1
Taking seriously	1	1
No response	2	2
Total	98	100

Looking at Table 6 , 24% of students expressed the value of kindness as "being respectful," 20% as "being kind, courteous," and 18% as "being nice." These are followed by expressions such as "Being tolerant," "Love," "Honesty," "Helping"... 2% of the students did not respond, writing "I don't know."

The sixth sub-problem of the research was formulated as "What are the situations that violate kindness according to 6th grade students?" The findings related to this sub-problem are presented in Table 7 below.

Table 7.

Student Opinions on Situations That Violate Kindness

Student Opinions on Situations That Violate Kindness	**f**	**%**
Bad behavior	23	22
Disrespect	16	15
Lying	12	11
Speaking harshly	10	9
Swearing	9	8
Bullying	5	5
Discrimination	5	4
Fighting	4	4

Arrogance	4	4
Selfishness	3	3
Mocking	2	2
Exclude	2	2
To strike	2	2
Jealousy	2	2
Kin	1	1
Gossip	1	1
Cheating	1	1
No response	4	4
Total	106	100

Looking at Table 7, students stated that "Bad behavior" was the most common situation that violated kindness, with a rate of 22%. Again, 15% of students stated "Disrespect" and 11% stated "Lying". Along with these, "Hurtful speech," "Swearing," "Bullying," "Discrimination," "Fighting," "Arrogance," "Selfishness," and other situations were also mentioned as situations that violate kindness. Four percent of the students did not express an opinion on this matter, either writing "I don't know" or leaving it blank.

Discussion, Conclusion, and Suggestions

Based on the opinions of 66 sixth-grade students at our school, this study was planned as a case study (example event) using qualitative research methods, with the aim of obtaining the opinions of sixth-grade middle school students on values. The results of this study are as follows:

Very few students in the study group reflected views that correctly expressed values education. Among these views, respect for people, being polite, valuing each other, etc., stood out. Students expressed views such as "Values education is the values that people care about in their daily lives" and "Values education is being polite to each other." Some of the students, however, reflected views that did not express values education. The views written by students such as "I think it is something like valuable education or getting a degree," and "I think values education could be evaluating our education on a subject" were evaluated as views that did not express values education. Half of the students had no idea what values education meant. These students wrote their opinions as "I don't know." Again, some of the students were not sure about the accuracy of their knowledge. "Isn't it education? Is it something related to education?" "Isn't good education a beneficial thing?" "Is it teaching different values as part of education?" "Is it education where we learn values?" "Is it something related to giving value to someone?"

It is seen that the students participating in the study attach importance to many values. Among these values, the values of "Respect," "Honesty," and "Kindness" stand out. However, some students did not respond, writing "I don't know" or leaving it blank. Again, some students wrote concepts such as class, game, study time, my cards, game time, health, academic and athletic success, friends, ambition, empathy, being cheerful... without being sure of their correctness. These were also considered responses that did not express value.

The values most frequently cited by students participating in the study as contributing to the development of friendships were "Honesty" and "Respect." These values are followed by "Kindness." "Cooperation," "Trust," "Love," "Sharing," and "Friendship" are other expressions they believe develop friendships. However, some students gave answers that did not express any values. These responses include, for example: communicating through conversation, forming groups for homework in class, establishing good relationships, getting along well, behaving well, playing games together, chatting, being positive, getting to know each other better, doing homework together, getting along well, socializing, meeting outside of school, joking around, empathy, spending time together, good behavior,

equality...

Students participating in the study stated that the situations that most disrupt friendships at school are "lying," "being rude, swearing," and "fighting." These situations were followed by disrespect, gossiping, selfishness, exclusion, betrayal/unreliability, bullying, jealousy, lack of empathy, mocking, sulking, hitting, discrimination, speaking without thinking, slander, cheating, hatred, and arrogance.

When asked how they could express the value of kindness , the students participating in the study expressed this value as "Behaving respectfully," "Being polite, courteous," and "Behaving well." These were followed by expressions such as "Being tolerant," "Love," "Honesty," "Helping"... Only a very small number of students responded by writing "I don't know."

Students participating in the study stated that "being rude" was at the top of the list of situations that disrupt kindness. Students also mentioned disrespectful behavior and lying as the main situations that disrupt kindness. Along with these, "hurtful speech," "swearing," "bullying," "discrimination," "fighting," "arrogance," "selfishness," and other behaviors were also mentioned as situations that violate kindness. A small number of students, did not express an opinion on this issue, either writing "I don't know" or leaving it blank.

Although there are few studies conducted in our country on values and values education, there are studies in other countries that highlight how values influence a country's political structure, education system, work productivity, and social welfare (Tatto et al., 2001; Wood and Roach, cited in Akbaş, 2004: 60). As reported by Tolunay Ateş (2017), a study aimed at determining which values are more important in schools yielded the following results: Participants ranked values from most important to least important as follows: responsibility, honesty, good citizenship, respect, cooperation, tolerance, honor, usefulness (being beneficial), internal discipline, compassion, justice, truthfulness, goal setting, service to others, perseverance, freedom of choice, faithfulness, generosity, individual rights, and courage. Aydın (2003) points out that the relationship between youth and values is two-way. According to Aydın, values play an important role in the formation of identity and personality during youth, in shaping one's view of the world and problem-solving style, while youth also plays an important role in the perception of values and their reshaping in society. Therefore, we believe that our study is important in terms of the development and education of children, who are our future, and that it will contribute to the field.

Recommendations:

1. Families and teachers can organize various activities inside and outside of school to reinforce the concept of kindness.
2. Families and teachers can use a language of communication that ensures children and young people internalize kindness not only as a form of behavior but also as an attitude and value, and they can serve as role models for its widespread adoption.
3. By developing games related to values education, children and young people can be helped to develop their values and put the use of expressions of kindness into practice through scenarios that mimic real-life situations.

Acknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Institutional Review Board Statement: To confirm that this study does not pose any ethical issues and to obtain permission for its implementation, written consent has been obtained from the administration of Edirne Bahçeşehir College.

Data Availability Statement: Researchers who wish to access the data used in this study can contact the authors directly. Since the data are not publicly available, interested researchers may reach out to

the corresponding author via iraz.demirsoz@stu.bahcesehir.k12tr to obtain information about the data access procedures. The data will be shared upon reasonable request in accordance with ethical guidelines and confidentiality requirements.

Conflict of Interest: Both authors declare that there are no financial, personal, or institutional relationships that could have influenced the research reported in this study. The authors confirm that there is no conflict of interest related to this research.

Generative Artificial Intelligence Statement: The authors declare that no generative artificial intelligence (AI) tools were used at any stage of the research or manuscript preparation process. This article was developed entirely by the authors without the use of AI-generated content, including text, images, or data.

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An Examination of the Relationship Between Special Education Teacher Candidates' Playfulness and Their Perceived Professional Self-Efficacy

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Abstract

This study was conducted to examine the relationship between special education pre-service teachers' playfulness tendencies and their perceptions of professional self-efficacy, as well as to determine whether these variables differ across various demographic factors. The research was carried out with 165 pre-service teachers enrolled in the Special Education Teaching Program at Trakya University Faculty of Education, employing quantitative research methods based on correlational survey and causal-comparative designs. During the data collection process, participants completed a Demographic Information Form, the Adult Playfulness Trait Scale, and the Teacher Self-Efficacy Scale. The data were analyzed using IBM SPSS 26, utilizing descriptive statistics in addition to Spearman's Rank Correlation Analysis, Independent Samples t-test, Mann-Whitney U, Kruskal-Wallis, and One-Way ANOVA. The findings revealed that pre-service teachers' playfulness tendencies were at a moderate level and did not significantly differ by gender, grade level, type of high school graduated from, or the type of settlement in which they grew up. Their professional self-efficacy perceptions, on the other hand, were found to be relatively high. While self-efficacy did not differ significantly by gender or settlement type, significant differences were observed by grade level and high school type. Self-efficacy scores increased as grade level advanced, with third- and fourth-year students reporting higher levels of self-efficacy than second-year students. Additionally, graduates of Anatolian High Schools had higher scores across all self-efficacy subdimensions compared to graduates of other high school types. Analysis of the playfulness scale subdimensions indicated a positive relationship between fun-seeking motivation and spontaneity, and a negative relationship between fun-seeking motivation and uninhibitedness. The subdimensions of professional self-efficacy (student engagement, instructional strategies, and classroom management) were also strongly and significantly interrelated. The most notable finding of the study was the positive and significant relationship between playfulness and professional self-efficacy. Pre-service teachers with higher fun-seeking motivation perceived themselves as more competent in engaging students, using instructional strategies, and managing classrooms. Overall, the results suggest that playfulness is a supportive factor in enhancing special education pre-service teachers' professional self-efficacy.

Keywords: Special education teacher, playfulness, professional self-efficacy

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Introduction

Education is regarded as a fundamental component in the development of modern societies (Kart, 2009), and teachers stand at the center of efforts to educate qualified individuals (Bektaş & Ayvaz, 2013; Karataş & Çakan, 2018). The teaching profession is defined as a specialized field requiring both knowledge and professional competence (Acat & Şişman, 2003; MEB, 1973), and teachers are expected to create learning environments that are effective, engaging, and conducive to learning (Ada & Küçükali, 2009). Special education teaching, which dates back to the 1800s, began to take institutional form in Turkey with the establishment of the Special Education Department at Gazi Education Institute in the 1950s (Gönüldaş & Gümüşkaya, 2022).

The placement of individuals with special needs into various educational settings based on age, diagnosis, and developmental characteristics (ÖEHY, 2018) necessitates that special education teachers possess a broad range of knowledge and skills. In this context, play is recognized as an effective tool in learning, assessment, and intervention processes (Finn & Fewell, 1994; Meyer, 2013; Weisberg et al., 2013a). Play supports children's cognitive, social, and emotional development (Adıgüzel, 2022; Stanley & Konstantareas, 2007) and provides a naturalistic setting for assessing children with special needs (Burak & Ahmetoğlu, 2019). Therefore, it is essential for special education teachers to develop knowledge, skills, and positive dispositions toward play.

Professional self-efficacy is another critical factor that influences teachers' ability to plan instruction, manage classrooms, and motivate students (Bandura, 1977; Akkoyunlu et al., 2005; Caprara et al., 2006). Teachers with high levels of self-efficacy have been shown to demonstrate stronger professional motivation and to create more effective learning environments.

Within this framework, the aim of the present study is to investigate the relationship between special education pre-service teachers' playfulness tendencies and their professional self-efficacy perceptions, as well as to examine whether these variables differ across demographic factors. The findings are expected to contribute to the existing literature and provide guidance for integrating play-based approaches into teacher education programs.

Based on the main research question, "Is there a relationship between the playfulness tendencies of pre-service special education teachers and their professional self-efficacy perceptions?", the following sub-problems were investigated.

1. What is the level of playfulness tendencies among pre-service special education teachers?
2. Do the playfulness tendencies of pre-service special education teachers differ significantly based on
   a. gender,
   b. year of study,
   c. type of high school graduated from,
   d. the type of residential area in which they were raised?
3. What is the level of professional self-efficacy perceptions among pre-service special education teachers?
4. Do the professional self-efficacy perceptions of pre-service special education teachers differ significantly based on
   a. gender,
   b. year of study,
   c. type of high school graduated from,
   d. the type of residential area in which they were raised?
5. Is there a significant relationship between the playfulness tendencies of pre-service special education teachers and their professional self-efficacy perceptions?

In this context, the dependent variables of the study are the playfulness tendencies and professional self-efficacy perceptions of pre-service special education teachers, while the independent variables are gender, year of study, type of high school graduated from, and the type of residential area in which they were raised.

Literature Review

Domestic Research on Games and Playfulness

A review of the relevant literature reveals a substantial body of research examining the relationships among individual dispositions, personality traits, perceptions of play, and professional self-efficacy. Aslan and Uluçınar Sağır (2012) reported that problem-solving skills do not differ by gender, grade level, or program type, emphasizing that individual characteristics are more influential than environmental factors. Aral and Kandır (2013) demonstrated that adults' perceptions of play are shaped by demographic variables and that play continues to serve an important psychological function in adulthood. Similarly, studies investigating the relationship between humor and personality traits (Demirtaş Madran, 2015) and those examining amusement-seeking and humor orientation (Yavuzer & Demirtaş, 2016) indicate that individual differences play a decisive role in humor- and entertainment-related behaviors.

Research on play-based approaches in teacher education (Altun & Öztürk, 2017; Bek & Genç, 2018) has shown that play-based learning enhances preservice teachers' classroom interaction, motivation, and professional self-efficacy. Studies conducted within the context of special education (Piştav Akmeşe & Kayhan, 2017; Özdemir & Eker, 2021) further reveal that play instruction and playfulness tendencies are positively associated with teachers' professional self-efficacy. Additional research indicates that playfulness tendencies are linked to personality traits and do not significantly differ across grade levels (Demirtaş, 2017; Aksoy & Korkmaz, 2019).

Studies exploring the relationship between play-, entertainment-, and motivation-related tendencies and personality traits (Gökalp & Eroğlu, 2021; Aksoy & Gür, 2020) suggest that play behaviors are shaped by individual differences. Finally, research highlighting the contribution of play perception to lifelong learning and teacher development (Kuzu & Şimşek Altıparmak, 2023), along with studies demonstrating the positive effects of humor in special education settings (Özyürek et al., 2023), collectively underscores the supportive role of play- and humor-based approaches in instructional processes.

Domestic Research on Professional Self-Efficacy

A review of the relevant literature shows that teacher self-efficacy is shaped through the interaction of educational experiences, environmental conditions, and individual characteristics, whereas gender generally does not appear to be a determining variable. Köseoğlu et al. (2007) reported that preservice teachers exhibit high levels of self-efficacy, with no significant differences based on gender; however, those enrolled in formal education programs demonstrated higher self-efficacy perceptions compared to their counterparts in distance education. Similarly, Demirtaş et al. (2011) found that preservice teachers' self-efficacy levels were high and positively associated with their attitudes toward the teaching profession. Yılmaz and Çoklar (2014) also identified no gender differences but revealed that students from non-education faculties possessed lower levels of self-efficacy.

Studies addressing the influence of experience and environmental factors (Can, 2016; Özdemir, 2017; Kırkıcı & Erdoğan, 2018; Turan & Koç, 2020) indicate that teachers' classroom management and professional self-efficacy perceptions are closely linked to professional experience and socio-cultural context. Individuals raised in urban settings tend to have higher levels of self-efficacy and motivation, whereas limited social support and educational opportunities in rural areas may negatively affect self-efficacy levels.

The reciprocal relationship between academic achievement and self-efficacy is emphasized by Yılmaz, Aydın, and Arslan (2018), while practice-oriented training processes have been shown to strengthen self-efficacy, as supported by Temizkan and Bulut (2018). Research in the context of special education and play-based instruction (Uygur Celep & Taymaz Sarı, 2024; Bayat, 2025) further demonstrates that mastery experiences, social support, and play-based pedagogical practices significantly enhance teachers' professional self-efficacy.

International Research on Games and Playfulness

A review of the literature indicates that play and playfulness constitute a multidimensional construct encompassing child development, adult psychology, and teacher competencies. Ginsburg (2007) highlighted that play is a fundamental mechanism supporting children's cognitive, social, emotional, and physical development, while also enhancing motivation, self-efficacy, and parent–child relationships. Studies examining playfulness in adults (Proyer, 2012; Barnett, 2016; Proyer, 2017; Proyer, 2017b) demonstrate that playfulness is largely independent of gender and demographic variables, and is instead strongly associated with personality traits, social context, and psychological well-being. These findings suggest that play tendencies cannot be adequately explained by superficial variables such as the type of high school attended.

Theoretically, Csikszentmihalyi's (2014) flow theory emphasizes that play experiences are closely tied to individual differences, whereas Ryan and Deci (2020) underscore the central role of intrinsic motivation in shaping play behavior. This theoretical framework helps explain why no meaningful differences are observed in playfulness across grade levels or age groups.

Research within the context of teacher education (Kim & Lee, 2020; Frede & Hodges, 2023; Dierenfeld, 2024; Darwich et al., 2025; O'Sullivan et al., 2025) demonstrates that play-based pedagogies enhance teachers' professional self-efficacy, classroom management skills, motivation, and social–emotional competencies. However, curriculum pressures, classroom management challenges, and lack of experience may constrain the implementation of such pedagogies. Overall, the findings indicate that play-based approaches play a critical role in the development of both students and preservice teachers.

International Research on Professional Self-Efficacy

A review of the literature indicates that play and playfulness constitute a multidimensional construct within the contexts of child development, adult psychology, and teacher competencies. Ginsburg (2007) emphasizes that play is a fundamental process supporting children's cognitive, social, emotional, and physical development. Studies examining playfulness in adults (Proyer, 2012; Barnett, 2016; Proyer, 2017; Proyer, 2017b) show that playfulness is largely independent of demographic variables and is instead associated with personality traits, psychological well-being, and social environment.

From a theoretical perspective, Csikszentmihalyi's (2014) flow theory suggests that play experiences are shaped by individual differences, while Ryan and Deci (2020) highlight the central role of intrinsic motivation in play-related behaviors. Together, these theoretical frameworks explain why playfulness does not significantly differ based on superficial variables such as age, grade level, or the type of high school attended.

Research conducted in the field of teacher education (Kim & Lee, 2020; Frede & Hodges, 2023; Dierenfeld, 2024; Darwich et al., 2025; O'Sullivan et al., 2025) demonstrates that play-based pedagogies enhance teachers' professional self-efficacy, classroom management skills, motivation, and socio-emotional competencies. However, curriculum pressures, limited experience, and classroom management demands may restrict the effective implementation of such approaches. Overall, the findings indicate that play-based practices hold a critical role in the development of both teacher candidates and students.

Method

In this study, the relationship between special education teacher candidates' playfulness tendencies and their professional self-efficacy beliefs was examined using the "Relational (Correlational) Survey Model," one of the quantitative research methods. This model aims to identify the relationships between two or more variables, determine the extent to which they change together, and assess the consistency of these relationships (Şata, 2020; Karasar, 2022). In addition, to determine whether teacher candidates' levels of playfulness and professional self-efficacy differ according to variables such as gender, year of study, high school type, and the type of settlement in which they grew up, the "Causal-Comparative Model" was also employed (Balcı, 2010; Can, 2016). Thus, in addition to identifying relational patterns, possible significant differences between groups were examined.

The population of the study consists of pre-service teachers enrolled in special education undergraduate programs during the 2024–2025 academic year. The sample includes 165 students studying in the Special Education Teacher Education Program at Trakya University Faculty of Education. Purposeful sampling was preferred, as it allows the researcher to select information-rich participants based on specific criteria and enhances the depth and meaningfulness of the study findings (Patton, 2014; Yıldırım & Şimşek, 2021).

Demographic analyses show that 54.5% of participants are female and 45.5% are male. The distribution across grade levels indicates balanced representation. Regarding high school background, the majority of participants graduated from Anatolian High Schools (61.2%). In terms of settlement type, 67.3% reported growing up in urban areas, while 32.7% grew up in rural environments. This diversity indicates that the sample reflects individuals from various socio-cultural and educational backgrounds.

Three instruments were used for data collection: the Demographic Information Form prepared by the researcher, the Adult Playfulness Trait Scale (APTS), and the Teacher Sense of Efficacy Scale (TSES). The Adult Playfulness Trait Scale (Shen, Chick & Zinn, 2014; Yurt, Keleş & Koğar, 2016) assesses individuals' tendencies toward play and entertainment under three subdimensions—fun-seeking, uninhibitedness, and spontaneity. It consists of 19 items with reliability coefficients ranging from .85 to .58. The Teacher Sense of Efficacy Scale (Tschannen Moran & Woolfolk Hoy, 2001; Çapa, Çakıroğlu & Sarıkaya, 2005) measures teachers' perceived efficacy regarding student engagement, instructional strategies, and classroom management, with an overall reliability coefficient of .93.

During data collection, formal permissions to use the scales were obtained from their authors, and ethical approval was secured. The scale items were transferred to an online survey format, which was administered to participants after an in-person briefing by the researcher. The collected data were recorded in IBM SPSS 26 and prepared for analysis. Negative items in the playfulness scale were reverse-coded, and analyses included descriptive statistics, Spearman's rank correlation, and group comparison tests such as independent samples t-test, Mann–Whitney U, Kruskal–Wallis, and ANOVA. The level of significance was set at .05.

Instead of total scores, item means were used in the analyses. This approach is widely recommended because it allows meaningful comparison between scales with differing item numbers and provides standardized interpretations (Büyüköztürk, 2019; Field, 2018). Item means for each subscale and total score were calculated using the "Compute Variable" function in SPSS, contributing to more consistent interpretation of the scale results.

For ethical compliance, the study received approval from the Trakya University Social and Humanities Research Ethics Committee on 18.06.2025, under decision number 2025.06.05..

Findings

1. Findings Regarding the Playfulness Tendencies of Special Education Teacher Candidates

Findings related to the first sub-problem of the study, *"What is the level of playfulness tendencies among pre-service special education teachers?"*, are presented in Table 1, including the minimum–maximum scores, arithmetic means, and standard deviations for the sub-dimensions of the Playfulness Tendency Scale (APTS).

Table 1.
Min-max, mean and standard deviation results of the general mean scores of the special education teacher candidates from APTS and its sub-dimensions

	N	Min Score	Max Score	x̄	ss
Fun-Seeking Motivation	165	1,22	4,00	3,40	,57
Uninhibitedness	165	1,20	3,40	2,20	,47
Spontaneity	165	1,00	4,00	2,99	,63
APTS Total Score Average	165	1,74	3,53	2,97	,33

Table 1 shows that pre-service special education teachers exhibit high fun-seeking motivation, lower uninhibitedness, and moderate spontaneity, resulting in an overall moderate level of playfulness. These findings suggest strong motivation toward play but more restrained tendencies in uninhibited behaviors.

2. Findings Regarding the Comparison of Special Education Teacher Candidates' Playfulness Tendencies with Their Demographic Characteristics

Findings related to the second sub-problem of the study, *"Do the playfulness tendencies of pre-service special education teachers differ significantly based on gender, year of study, type of high school graduated from, and the type of residential area in which they were raised?"*, are presented below in order.

As shown in Table 2, the APTS scores did not meet normality assumptions for either gender (Shapiro–Wilk $p < .05$). Therefore, gender comparisons were conducted using the non-parametric Mann–Whitney U test.

Table 2.
Mann-Whitney U test results of special education teacher candidates' playfulness tendencies according to gender variable

Sub-dimensions	High School Type	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p
Fun-Seeking Motivation	Female	90	87,79	7901,00	2944,000	0,157
	Male	75	77,25	5794,00		
Uninhibitedness	Female	90	82,76	7448,00	3353,000	0,942
	Male	75	83,29	6247,00		
Spontaneity	Female	90	83,27	7494,50	3350,500	0,936
	Male	75	82,67	6200,50		
APTS Total Score Average	Female	90	87,67	7890,00	2955,000	0,169
	Male	75	77,40	5805,00		

*p<0.05; **p< 0.01; N=165

Table 2 indicates that no statistically significant differences were found between female and male pre-service teachers in any sub-dimension or in the total playfulness score ($p > .05$).

Table 3 presents the results regarding differences in playfulness tendencies by year of study. Although skewness and kurtosis values indicated near-normal distributions, normality tests (Kolmogorov–Smirnov and Shapiro–Wilk) showed violations of normality for 1st- and 2nd-year students, with mixed results for 3rd- and 4th-year groups. Accordingly, the Kruskal–Wallis test was deemed appropriate for comparing APTS scores across year levels.

Table 3.
Kruskal-Wallis test results of special education teacher candidates' playfulness tendencies according to grade level variable

Sub-dimensions	Class level	N	Mean Rank	Sd	χ^2	p	Source of Difference

Fun-Seeking Motivation	1st Grade	42	75,31	3	4,728	,193	There is no difference
	2nd Grade	59	78,75				
	3rd Grade	31	97,73				
	4th Grade	33	86,56				
Uninhibitedness	1st Grade	42	94,79	3	4,145	,246	There is no difference
	2nd Grade	59	78,25				
	3rd Grade	31	74,81				
	4th Grade	33	84,18				
Spontaneity	1st Grade	42	81,30	3	1,430	,698	There is no difference
	2nd Grade	59	88,03				
	3rd Grade	31	83,16				
	4th Grade	33	76,02				
APTS Total Score Average	1st Grade	42	81,93	3	1,046	,790	There is no difference
	2nd Grade	59	80,19				
	3rd Grade	31	90,71				
	4th Grade	33	82,14				

*p<0.05, **p<0.01

Table 3 indicates that there are no statistically significant differences in playfulness tendencies across year levels ($p > .05$). Mean ranks for each sub-dimension and the total APTS score varied across classes, but none of the χ^2 values (ranging from 1.046 to 4.728) reached significance ($p = .193–.790$). Overall, playfulness tendencies and all related sub-dimensions did not differ significantly by year of study among pre-service special education teachers.

Table 4 presents the findings regarding differences in playfulness tendencies by high school type. The distribution of total APTS scores showed slight negative skewness (–0.873) and mild kurtosis (0.353). Normality tests (Kolmogorov–Smirnov and Shapiro–Wilk) indicated non-normal distributions for both Anadolu High School graduates and other high school groups ($p < .05$). Therefore, non-parametric analyses (Mann–Whitney U) were deemed appropriate for comparing APTS scores across high school types

Table 4.

Mann-Whitney U test results of special education teacher candidates' playfulness tendencies according to high school type variable

Sub-dimensions	High School Type	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p
Fun-Seeking Motivation	Anatolian High School	101	85,99	8685,00	2944,000	0,157

Sub-dimensions	High School Type	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p
	Other High Schools	64	78,28	5010,00		
Uninhibitedness	Anatolian High School	101	82,76	8359,00	3353,000	0,942
	Other High Schools	64	83,38	5336,00		
Spontaneity	Anatolian High School	101	82,47	8329,00	3350,500	0,936
	Other High Schools	64	83,84	5366,00		
APTS Total Score Average	Anatolian High School	101	84,63	8547,50	2955,000	0,169
	Other High Schools	64	80,43	5147,50		

*p<0.05, **p<0.01

As shown in Table 4, Mann–Whitney U test results indicated no statistically significant differences in any APTS sub-dimension or in the total score based on high school type (p > .05). Although Anadolu High School graduates had slightly higher mean ranks than graduates of other schools, these differences were not significant. Overall, playfulness tendencies of pre-service special education teachers do not vary according to the type of high school they graduated from.

Table 5 shows that the APTS total scores did not meet normality assumptions for either the urban or rural groups, as indicated by significant Kolmogorov–Smirnov and Shapiro–Wilk test results (p < .05). Skewness (–0.873) and kurtosis (0.353) values also reflected a slightly negatively skewed and mildly platykurtic distribution. Therefore, non-parametric analyses (Mann–Whitney U) were deemed appropriate for comparing scores across residential area groups.

Table 5.
Mann-Whitney U test results of the playfulness tendencies of special education teacher candidates according to the place of residence where they grew up

Sub-Dimensions	Location	N	Rank Mean	Rank Sum	Mann-Whitney U	p
Fun-Seeking Motivation	Urban	111	85,07	9442,50	2767,500	0,423
	Rural	54	78,75	4252,50		
Uninhibitedness	Urban	111	81,91	9092,50	2876,500	0,673
	Rural	54	85,23	4602,50		
Spontaneity	Urban	111	82,82	9193,50	2977,500	0,946
	Rural	54	83,36	4501,50		
APTS Total Average Score	Urban	111	84,82	9414,50	2795,500	0,483

Sub-Dimensions	Location	N	Rank Mean	Rank Sum	Mann-Whitney U	p
	Rural	54	79,27	4280,50		

*p<0.05, **p<0.01

As shown in Table 5, no statistically significant differences were found between urban and rural groups in any of the three sub-dimensions or in the total APTS score (p > .05). Mann–Whitney U test results for fun-seeking motivation, uninhibitedness, spontaneity, and the overall score all indicated non-significant differences. These findings suggest that the residential area in which pre-service special education teachers grew up does not have a meaningful influence on their playfulness tendencies.

3. Findings Regarding the Professional Self-Efficacy Perceptions of Special Education Teacher Candidates

Findings related to the third sub-problem, *"What is the level of professional self-efficacy perceptions among pre-service special education teachers?"*, are presented in Table 6, including the minimum–maximum scores, arithmetic means, and standard deviations for the sub-dimensions of the Teacher Self-Efficacy Scale.

Table 6.

Min-Max, Mean and Standard Deviation Values of the Average Scores Received by Special Education Teacher Candidates on the TSES

Sub-Dimensions	N	Min Score	Max Score	x̄	ss
Student Engagement	165	2,13	9,00	6,05	1,32
Teaching Strategies	165	1,88	9,00	6,10	1,32
Classroom Management	165	2,13	9,00	6,07	1,37
TSES Total Score Average	165	2,17	9,00	6,07	1,30

Table 6 indicates that pre-service special education teachers report consistently high self-efficacy levels across all sub-dimensions, with similar mean scores for student engagement, instructional strategies, and classroom management. Overall results suggest that participants generally perceive themselves as professionally competent.

4. Findings Regarding the Comparison of Professional Self-Efficacy Perceptions of Special Education Teacher Candidates with Their Demographic Characteristics

Table 7 presents the findings regarding gender differences in professional self-efficacy. Mean total scores were similar for females (M = 6.07, SD = 1.30) and males (M = 6.01, SD = 1.30). Skewness and kurtosis values indicated approximately normal and symmetric distributions for both groups. Normality tests (Kolmogorov–Smirnov and Shapiro–Wilk) were non-significant for males and females (p > .05), confirming normal distribution. Therefore, gender comparisons were conducted using parametric analyses (independent samples t-test).

Table 7.

Independent samples t-test results of professional self-efficacy perceptions of special education teacher candidates according to gender variable

Sub-dimensions	Gender	N	x̄	ss	t	sd	p
Student Engagement	Female	90	6,194	1,12	1,527	134,664	,129
	Male	75	5,873	1,50			
Teaching Strategies	Female	90	6,126	1,18	,266	139,940	,791

	Male	75	6,070	1,49			
Classroom Management	Female	90	6,115	1,20	,470	137,401	,639
	Male	75	6,012	1,56			
TSES Total Score Average	Female	90	6,145	1,13	,769	136,974	,443
	Male	75	5,985	1,48			

*p<0.05; **p< 0.01; N=165

As shown in Table 7, mean scores for females and males were similar across the student engagement, instructional strategies, and classroom management sub-dimensions, as well as in the overall self-efficacy score. Independent samples t-test results indicated no statistically significant gender differences in any sub-dimension or in the total score. These findings suggest that gender does not have a meaningful effect on the professional self-efficacy perceptions of pre-service special education teachers.

Table 8 presents the mean and standard deviation values of self-efficacy scores by year level, and Table 9 shows the ANOVA results. Normality analyses using Kolmogorov–Smirnov and Shapiro–Wilk tests indicated that total self-efficacy scores were normally distributed across all grade levels ($p > .05$). Given the normal distribution, one-way ANOVA was deemed appropriate for comparing self-efficacy scores by year of study.

Table 8.
The mean and standard deviation results of the scores obtained by the special education teacher candidates from the TSES regarding their class levels.

Grade Level	x̄	ss
1st Grade	6,04	1,12
2nd Grade	5,60	1,50
3rd Grade	6,62	1,23
4th Grade	6,44	,85

Table 8 shows that mean self-efficacy scores were highest among 3rd- and 4th-year students, followed by 1st-year students, while 2nd-year students reported slightly lower scores. Standard deviation values indicate that 4th-year students demonstrated the most consistent (homogeneous) self-efficacy perceptions. Although some variation across grade levels is observable, these differences appear relatively limited in magnitude.

Table 9.
Results of one-way analysis of variance (ANOVA) on professional self-efficacy perceptions of special education teacher candidates according to grade level variable

		Sum of Squares	Sd	Mean of Squares	F	p	Source of Difference
Student Engagement	Intergroup	27,9	3	9,3	5,835	,001*	1<3 2<3 2<4
	Intragroup	256,3	161	1,6			
	Total	284,1	164				
Teaching Strategies	Intergroup	21,0	3	7,0	4,222	,007*	2<3 2<4
	Intragroup	266,7	161	1,7			
	Total	287,7	164				

Classroom Management	Intergroup	31,9	3	10,6	6,153	,001*	1<3 2<3 2<4
	Intragroup	277,9	161	1,7			
	Total	309,8	164				
TSES Total Score Average	Intergroup	26,7	3	8,9	5,715	,001*	2<3 2<4
	Intragroup	250,8	161	1,6			
	Total	277,5	164				

*p<0.05, **p<0.01

Table 9 shows that self-efficacy scores differ significantly by year level across all sub-dimensions. For *student engagement*, 3rd-year students scored significantly higher than 1st- and 2nd-year students, and 4th-year students scored higher than 2nd-year students, indicating increased confidence as students progress. In the *instructional strategies* sub-dimension, 2nd-year students reported significantly lower scores than 3rd- and 4th-year students, suggesting that growing instructional experience enhances self-efficacy. For *classroom management*, 3rd-year students scored significantly higher than 1st- and 2nd-year students, and 4th-year students again scored higher than 2nd-year students. Overall self-efficacy scores were also significantly lower for 2nd-year students compared with 3rd- and 4th-year students. These findings indicate that professional self-efficacy generally increases with year level, with 3rd- and 4th-year students showing the highest levels across all sub-dimensions.

Table 10 presents the results regarding differences in self-efficacy by high school type. Normality tests indicated that the total self-efficacy scores were normally distributed for both Anadolu High School graduates (Shapiro–Wilk p = .565; Kolmogorov–Smirnov p = .068) and graduates of other high schools (Shapiro–Wilk p = .162). Since p-values exceeded .05 for both groups, the data were considered normally distributed, allowing for parametric comparisons.

Table 10.

The mean and standard deviation results of the scores obtained by the special education teacher candidates from the TSES regarding the type of high school they graduated from

Type of High School Graduated	x̄	ss
Anatolian High School	6,28	1,13
Other High Schools	5,73	1,49

As shown in Table 10, Anadolu High School graduates had a higher and more homogeneous mean self-efficacy score (M = 6.28, SD = 1.13) compared with graduates of other high schools (M = 5.73, SD = 1.49). This indicates that Anadolu High School graduates not only reported higher self-efficacy but also exhibited less variability in their scores, whereas scores among other high school graduates were lower and more dispersed.

The results of the independent samples t-test examining whether the professional self-efficacy perceptions of pre-service special education teachers differ by high school type are presented in Table 11.

Table 11.

Independent samples t test results of professional self-efficacy perceptions of special education teacher candidates according to high school type variable

Sub-dimensions	Type of High School Graduated	N	Mean	Std. Deviation	t	p
Student Engagement	Anatolian High School	101	6,23	1,28	2,224	0,028
	Other High Schools	64	5,77	1,36		
Teaching Strategies	Anatolian High School	101	6,45	1,30	2,586	0,011
	Other High Schools	64	5,91	1,25		
Classroom Management	Anatolian High School	101	6,78	1,40	2,942	0,004
	Other High Schools	64	6,15	1,35		
TSES Total Score Average	Anatolian High School	101	6,49	1,22	2,665	0,008
	Other High Schools	64	5,95	1,28		

*p<0.05, **p<0.01

As shown in Table 11, Anadolu High School graduates demonstrated higher mean scores than other high school graduates across all self-efficacy sub-dimensions and in the total score. Independent samples t-test results indicated statistically significant differences in student engagement (t(163) = 2.224, p = .028), instructional strategies (t(163) = 2.586, p = .011), and classroom management (t(163) = 2.942, p = .004), as well as in overall self-efficacy (t(163) = 2.665, p = .008). These findings show that Anadolu High School graduates possess generally higher professional self-efficacy perceptions compared to graduates of other high school types.

The normality analyses conducted for the total teacher self-efficacy scores by settlement type, as presented in Table 12, indicated that the data met the assumption of normal distribution for both groups. The Kolmogorov–Smirnov and Shapiro–Wilk tests yielded p-values above .05 for participants raised in urban areas (p = .200; p = .444) and in rural areas (p = .200; p = .659). These results confirm that the distribution of self-efficacy scores is normal in both groups, supporting the use of parametric analyses (independent samples t-test) to examine differences based on settlement type.

Table 12.
Independent samples t test results of the professional self-efficacy perceptions of special education teacher candidates according to the place of residence where they grew up variable

Sub-dimensions	Gender	N	x̄	ss	t	sd	p
Student Engagement	Urban	111	6,05	1,29	0,313	163	0,754
	Rural	54	6,11	1,35			
Teaching Strategies	Urban	111	6,09	1,32	-0,601	163	0,549
	Rural	54	6,22	1,28			
Classroom Management	Urban	111	6,12	1,34	0,052	163	0,959
	Rural	54	6,11	1,31			
TSES Total Score Average	Urban	111	6,09	1,30	-0,080	163	0,936
	Rural	54	6,11	1,31			

*p<0.05; **p< 0.01; N=165

Table 12 shows that independent samples t-tests yielded no significant differences between candidates raised in urban and rural areas across any self-efficacy dimension (student engagement, instructional strategies, classroom management) or in total scores. These results indicate that place of upbringing does not meaningfully influence special education pre-service teachers' professional self-efficacy levels.

5. Findings on the Relationship Between Special Education Teacher Candidates' Playfulness Tendencies and Their Professional Self-Efficacy Perceptions

The findings addressing the fifth and final research question—*"Is there a significant relationship between special education pre-service teachers' playfulness tendencies and their professional self-efficacy perceptions?"*—are presented in Table 13. Normality analyses indicated that APTS total scores did not follow a normal distribution, as both the Kolmogorov–Smirnov (p = 0.000) and Shapiro–Wilk (p = 0.000) tests were significant. In contrast, TSES total scores were normally distributed, supported by non-significant Kolmogorov–Smirnov (p = 0.091) and Shapiro–Wilk (p = 0.121) results. Given that one of the variables violated the assumption of normality, the relationship between APTS and TSES was examined using the non-parametric Spearman rank-order correlation.

Table 13.

Spearman's rank correlation analysis values regarding the relationship between playfulness tendencies and professional self-efficacy perceptions of special education teacher candidates.

Sub-dimensions	1	2	3	4	5	6	7	8
1. Fun-Seeking Motivation	-							
2. Uninhibitedness	-,512**	-						
3. Spontaneity	,588**	-,470**	-					
4. Student Engagement	,215**	,062	,044	-				
5. Teaching Strategies	,171*	,065	,046	,881**	-			
6. Classroom Management	,238**	,031	,103	,895**	,913**	-		
7. APTS Total Score Average	,860**	-,258**	,792**	,201**	,161*	,221**	-	
8. TSES Total Score Average	,223**	,047	,073	,954**	,963**	,972**	,208**	-

p < .01**, p < .05*; *N*=165

The analysis results indicate that there are significant relationships between special education pre-service teachers' playfulness tendencies and their professional self-efficacy perceptions.

The sub-dimensions of playfulness are significantly related to one another:

- There is a strong negative relationship between *fun-seeking motivation* and *uninhibitedness*.
- A strong positive relationship exists between *fun-seeking motivation* and *spontaneity*.
- A negative relationship was also found between *uninhibitedness* and *spontaneity*.

There are also positive relationships between playfulness and professional self-efficacy: Fun-seeking motivation shows moderate, positive, and significant correlations with student engagement, instructional strategies, and classroom management. Additionally, a positive and significant relationship was found between total playfulness scores and total professional self-efficacy scores. Very high-level positive correlations were observed among the sub-dimensions of professional self-efficacy, indicating that these dimensions complement one another. Overall, the findings show that pre-service teachers with higher levels of playfulness tend to have higher professional self-efficacy perceptions. This suggests

that being open to and motivated by play-based approaches contributes to stronger professional self-efficacy.

Discussion, Conclusion, and Suggestions

This study examined the playfulness tendencies and professional self-efficacy perceptions of special education teacher candidates in relation to various demographic variables. The findings were systematically evaluated according to the sub-problems concerning playfulness and professional self-efficacy.

Playfulness tendencies were analyzed through the sub-dimensions of the motivation for fun, lack of restraint, and spontaneity. The mean score of 3.40 in the motivation for fun sub-dimension indicates that teacher candidates are highly motivated to engage in enjoyable activities. In contrast, a low mean score of 2.20 in the lack of restraint sub-dimension suggests that candidates are cautious about freely enjoying themselves despite social norms. The spontaneity sub-dimension showed a mean score of 2.99 with relatively high standard deviation, highlighting considerable individual differences in spontaneous playful behavior. The overall playfulness score was 2.97, indicating that special education teacher candidates generally demonstrate moderate tendencies toward playfulness.

Analyses based on gender revealed no significant differences between male and female candidates in either the sub-dimensions or the total playfulness scores. Similarly, class level, type of high school graduated from, and place of upbringing did not yield statistically significant differences in playfulness tendencies. These findings suggest that playfulness is primarily influenced by individual characteristics, intrinsic motivation, and psychosocial factors, rather than demographic variables. Consistent with the literature, play and recreational behaviors are shaped more by personal tendencies and motivation than by gender, academic year, or environmental factors.

Regarding professional self-efficacy perceptions, special education teacher candidates generally exhibited a high level of perceived competence. Mean scores for the sub-dimensions of student engagement, instructional strategies, and classroom management were 6.05, 6.10, and 6.07, respectively, with an overall mean of 6.07. These results indicate that candidates feel confident in their professional knowledge, skills, and practices, and are capable of facilitating active student participation in learning processes. Low standard deviations in the sub-dimensions suggest a relatively homogeneous distribution of self-efficacy perceptions among candidates.

Gender-based analyses indicated that female candidates' self-efficacy scores were slightly higher than those of male candidates, though the differences were not statistically significant. This suggests that professional self-efficacy is shaped independently of gender and primarily depends on individual competence beliefs. Analyses by class level revealed significant differences; second-year candidates reported lower self-efficacy compared to other class levels, while third- and fourth-year candidates displayed the highest scores across sub-dimensions. These findings indicate that professional experience and progression through the teacher education program enhance self-efficacy perceptions, with practice and experiential learning positively influencing candidates' professional confidence.

Analyses according to high school type showed that graduates from Anatolian High Schools had higher self-efficacy scores across all sub-dimensions and total scores compared to graduates of other school types, suggesting that educational background may influence professional self-efficacy. In contrast, no significant differences were found regarding candidates' place of upbringing, indicating a limited impact of environmental factors on self-efficacy perceptions.

Correlation analyses revealed positive and significant relationships between the motivation for fun and the sub-dimensions of student engagement, instructional strategies, and classroom management. Additionally, a significant positive correlation was found between overall playfulness and professional self-efficacy scores. These results suggest that candidates who are open and motivated toward play-based approaches tend to exhibit stronger professional self-efficacy. Consequently, play-based activities may serve as an effective tool to enhance both pedagogical skills and professional confidence among teacher candidates.

The discussion section compared these findings with existing literature. The high motivation for fun indicates a potential predisposition among candidates to adopt play-based learning strategies. The low score in the lack of restraint sub-dimension suggests caution in challenging social norms, while individual differences in spontaneity point to variability in creativity and flexibility. The moderate overall playfulness score indicates that candidates in different disciplines may exhibit varied tendencies toward play-based learning.

High professional self-efficacy scores support Bandura's (1997) self-efficacy theory, emphasizing that self-confidence plays a critical role in performance and professional development. High scores in student engagement, instructional strategies, and classroom management indicate that candidates possess well-developed professional knowledge, skills, and competencies. Differences by class level underscore the role of experience and progressive learning in strengthening self-efficacy, while differences according to high school type suggest that educational background can shape candidates' professional competence perceptions.

The findings demonstrate a positive and significant relationship between playfulness tendencies and professional self-efficacy, with gender and place of upbringing not serving as significant determinants. The results highlight the potential of integrating play-based approaches into teacher education programs to enhance pedagogical skills and professional confidence, ensuring equal opportunities for all candidates regardless of class level or educational background.

Based on these results, several recommendations were made to advance research and practice. For researchers, it is suggested to conduct qualitative studies to understand the underlying reasons for playfulness and self-efficacy perceptions, include psychosocial variables such as empathy, communication skills, humor, and types of motivation in analyses, and implement longitudinal studies to observe changes over time. Expanding research to candidates from other teaching disciplines and evaluating the effectiveness of play-based learning modules through experimental designs are also recommended, including cross-cultural studies to explore potential cultural differences.

For practitioners and field experts, the study recommends incorporating play-based instructional strategies into in-service training, organizing training programs on play-based teaching techniques and classroom applications, and increasing practical activities to enhance classroom management skills. Mentorship, supervision, and workshop programs can further strengthen self-efficacy perceptions. Given the link between playfulness and professional motivation, additional support in stress management, motivation enhancement, and creative drama is also advised.

Overall, these recommendations aim to enhance pedagogical competence, self-efficacy, and openness to play-based learning among special education teacher candidates, providing a comprehensive and practice-oriented framework for research and professional development.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Data Availability Statement: Researchers who wish to access the data used in this study can contact the authors directly. Since the data are not publicly available, interested researchers may reach out to the corresponding author via muhammed.0292@outlook.com to obtain information about the data access procedures. The data will be shared upon reasonable request in accordance with ethical guidelines and confidentiality requirements.

Conflict of Interest: Both authors declare that there are no financial, personal, or institutional relationships that could have influenced the research reported in this study. The authors confirm that there is no conflict of interest related to this research.

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Social Factors in Children's Personality

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Abstract

To understand the psychological and social life of children as a whole and to comprehend their personality, alongside the phenomena and psychological processes, we must also be familiar with the qualities of personality. By analyzing these social factors, we aim to increase awareness among parents, educators, and teachers. This study will highlight the reasons and influencing factors that contribute to the formation of children's personalities, examining the different roles played by social factors. The approach method in this study is theoretical, specifically by analyzing psychosocial theories, recent research from field experts, to understand the interaction of social factors in personality formation, as well as from the perspective of socialization theory, it delves into the impact mechanism of the socialization process on the formation of children's personality, emphasizing the close connection between children's self-identity, emotional regulation, behavioral expression, and socialization. This study represents an additional effort in this direction, specifically to analyze the formative factors from various social perspectives, including peer relationships, the school environment, and the impact of social media. Special attention will be given to interaction with peers through social networks (online). Paradoxically, peers are a source of intimacy and support, but also stress and victimization. With the advent of online contexts such as social media, many interpersonal interactions have transitioned to these online venues. The formation of a child's personality is a complex process influenced by multiple factors. The more research, analysis, and discussions there are about the interaction of these factors, the more we can help the health development of children's personalities.

Keywords: formation, personality, factors, social, children.

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Introduction

Discussing personality is both beautiful and challenging, because when we refer to someone's personality, we speak of what makes that individual unique, different from others. Through this paper, we aim to understand how to make it easier to reach that beauty. Above all, we are interested in the factors that influence personality formation. In this paper, we will focus primarily on social factors, including educational institutions such as kindergartens and schools, the influence of peers, with special emphasis on "unknown" peers whom children interact with through online games, and the significant role of social media, which today provides rapid and powerful access to children. The concept of personality holds great importance in many fields of psychology, and numerous theories have been developed to explain personality traits as accurately as possible. In this paper, we will explore those theories that emphasize the psychosocial aspect, particularly those that consider social factors as determinants in shaping and developing a well-defined personality. These include: Franklin Henry Giddings' Theory of Socialization, Erik Erikson's Theory of Psychosocial Development, and Albert Bandura's Social Learning Theory. By researching and analyzing the latest studies in this field, we aim to uncover meaningful insights about social factors and children's personality development and to pass these findings on to our students, who will one day work as educators and teachers.

The Importance of Social Factors in Children's Personality Development

To understand the psychological and social life of children and grasp their personality, we must go beyond psychological phenomena and processes; we must also understand the qualities of personality. By analyzing these social factors, we aim to raise awareness among parents, educators, and teachers not to change children's personalities, but to help them become the best version of themselves emotionally, socially, and intellectually. From the moment of birth, the child forms a social relationship, as all of their needs are met by an adult. This person becomes the center of attention for the newborn. Love, attention, and continuous communication with the infant create a socially mediated need for new impressions, the need to see more, hear more, touch more, and be touched more. These needs are fulfilled through the mediator, and the more present and positive the contact is, the greater the likelihood of healthy physical and emotional development in the child's early stages. Through contact with others, the child begins the process of socialization. They develop into a human being with human traits, distinct from other beings. In interaction with their environment, the child learns and acquires specific behavioral forms essential for social life, thus forming an independent and well-rounded personality. It is important to emphasize that personality is a complex formation of the human psyche, encompassing cognitive capacities, emotions, willpower, and character and temperament traits. (Leontiev, 1978). Personality is a system composed of distinct psychological functions that, when integrated, characterize the unique form of each individual. It is a stable system, marked by consistent reactions to events (relative behavioral unity) and personal values. Children with more developed personalities are better able to control their behavior and actively seek solutions in various situations. In the work "Psychology: A Concise Introduction," the author Pettijohn (1996) presented two definitions that we believe are important to mention in our paper, namely the definition of personality by psychologists Walter Mischel, Feshbach, and Weiner. Psychologist Walter Mischel defines personality as general, stable, and distinctive behavior patterns in response to people and events, characteristic behavioral models that remain consistent across different situations. Feshbach and Weiner also emphasize social relationships when defining personality as relatively stable behavior patterns that distinguish individuals, groups, and cultures.

Theories Supporting the Importance of Social Factors in Children's Personality Development

Psychologists and sociologists hold differing views regarding the study of personality. Some focus on identifying the most important traits of personality, while others seek to understand why personality varies. Among the latter group, some consider family as the most influential factor in personality development, while others emphasize the importance of influences outside the family. In this paper, we aim to present the support offered by several psychosocial theories that provide analytical frameworks to explain external social factors such as educational institutions, peers, and social media.

Franklin Henry Giddings' Theory of Socialization

Franklin Henry Giddings, one of the first American sociologists, conceptualized socialization as a fundamental process for building social life and shaping personality. At the heart of his theory lies the concept of "consciousness of kind," the idea that individuals feel connected to others due to perceived similarity, which fosters interaction and the formation of social relationships. According to Giddings (1897), children develop their personalities through interactions with others, internalizing norms, values, and behaviors accepted within their social group. This sense of belonging forms the basis for identity and cultivates feelings such as empathy, solidarity, and cooperation. Giddings (1897) emphasized that socialization is not merely an external process, but an internal transformation, where the child builds their personality by reflecting on social experiences and integrating them into their consciousness. This approach makes his theory particularly valuable for understanding how children form their identities through everyday interactions.

Erik Erikson's Theory of Psychosocial Development

Erik Erikson, another prominent psychosocial theorist, viewed personality formation as a process intertwined with psychological development and the influence of social factors, including family, school, peers, and broader sociocultural elements. According to Erikson (1950), development follows an epigenetic principle, meaning that personality unfolds through a predetermined sequence of eight stages. Progress through each stage is partly determined by success or failure in previous stages. Each stage involves specific psychosocial tasks and has an optimal time for resolution. It is neither useful to rush children toward adulthood nor possible to delay their progress or shield them from life's demands. There is a time for every task. Below are Erikson's eight stages of psychosocial development, illustrating how social factors play a crucial role in personality formation not only during childhood but throughout life. They are: Trust vs. Mistrust (0–1 year); Autonomy vs. Shame and Doubt (1–3 years); Initiative vs. Guilt (3–6 years); Zeal vs. Inferiority (6–12 years); Identity vs. Role Confusion (12–18 years); Intimacy vs. Isolation (18–40 years); Productivity vs. Stagnation (40–65 years); Integrity vs. Despair (65+ years). (Boeree, 2004).

• The first stage, trust versus mistrust (0–1 year), occurs in the child's relationship with caregivers. If the child experiences consistent care and love, they develop trust in the world; otherwise, they may develop insecurity and fear of others.

• The second stage, autonomy versus shame and doubt (1–3 years), is related to the child's ability to act independently. Support from parents in exploring the environment helps develop self-confidence, while excessive punishment can lead to feelings of shame and insecurity.

• In the third stage, initiative versus guilt (ages 3–6), children begin to take action and show creativity. If their efforts are accepted and encouraged, they develop a sense of purpose; if they are criticized or discouraged, they may feel guilty for wanting to act.

• The fourth stage, industry versus inferiority (6–12 years), is closely related to schooling and interactions with peers. Children learn to assess their abilities through academic and social success. Support from teachers and the group helps in developing self-esteem; conversely, continuous failure can lead to a sense of incapacity.

• The fifth stage, identity versus role confusion (12–18 years), is central to personality formation. The adolescent tries to understand who they are and what role they have in society. The influence of peers, culture, and social expectations is crucial in building a clear identity.

• The sixth stage, intimacy versus isolation (ages 18–40), is associated with the ability to build deep and lasting relationships. A well-formed identity allows the individual to connect with others; otherwise, they may experience loneliness and emotional isolation.

• The seventh stage, productivity versus stagnation (ages 40–65), involves an individual's contribution to society through work, family, and community. A sense of purpose and positive impact helps maintain emotional balance; a lack of engagement can lead to feelings of emptiness.

• Stage eight, integrity versus despair (65+ years), is about reflecting on life. If the

individual feels they have lived meaningfully, they experience peace and acceptance; otherwise, they may experience regret and despair. These stages are not separate from each other, but build upon one another, reflecting the influence of social factors at every stage of life. Social interactions in each stage are crucial for resolving psychosocial crises and for developing a balanced and stable personality.

Albert Bandura's Social Learning Theory

Albert Bandura, one of the most influential psychologists of the 20th century, developed the Social Learning Theory, which emphasizes that behavior and personality are primarily shaped through observation, imitation, and modeling of others' behaviors (Boeree, 2004). According to Bandura, individuals learn not only through direct experience but also by observing others and the consequences of their actions. This process, known as observational learning, is especially important in childhood, when children are highly sensitive to the influence of social figures such as parents, teachers, peers, and media personalities. Bandura also highlights the role of self-efficacy, the belief in one's ability to achieve goals. This belief is shaped through social experiences, particularly when individuals witness others succeed in similar situations (Bandura, 1997). Thus, social factors influence not only behavior but also the development of personal confidence and motivation. A recent study published on Research.com (Bouchrika, 2025) examines the modern application of Bandura's theory in interdisciplinary education and digital learning programs. It emphasizes that modeling behavior by relatable figures (e.g., teachers, mentors, peers) remains a key mechanism in online education, especially after the pandemic. The study suggests that such modeling significantly impacts students' motivation and self-efficacy. These findings, along with other contemporary research, confirm that Bandura's Social Learning Theory remains highly relevant, particularly in educational, digital, and professional contexts. It continues to offer valuable insights into how personality is shaped through social interaction, modeling, and self-reflection, making it a powerful tool for educators, psychologists, and sociologists.

The Role of Educational Institutions in Shaping Children's Personality

Today's concept of education is accompanied by a comprehensive process of discovery, recognition, and deep formation of each child's personality, as well as the development of their self-image. Educational institutions play a vital role in preparing children to attain a more advanced social status, clearly defining the stages for stable personality development so that the child can more easily adapt to society. Another important role of these institutions is the transmission of cultural and social heritage across generations, enabling children to interact more easily with their peers and those around them. Kindergarten and school play a key role in refining the child's personality, as this is an educational process carried out by society through its institutions, intending to form a personality capable of social interaction and intellectual independence within the framework of social relationships. Through these relationships, the child develops a social personality. (Thompson, 2006). Unlike the family, school is another important institution where the child's personality continues to develop in a more organized manner. At school, the child encounters a new environment, with new conditions and circumstances to which they must adapt. Through organized work in school, society achieves its goals with the younger generation. In school, through continuous contact with teachers and other students, children form social attitudes and worldviews. School is the place where children build new relationships with peers, gain experience, and continue to develop intellectually, emotionally, and socially. (Thompson, 2006). Through planned lessons, free activities, and direct interactions, schools influence the acquisition of positive qualities that are desirable for society. Children also acquire knowledge, skills, and habits. School is the most suitable place to prevent negative traits, and teachers play a crucial role in this. The teacher's personality should be close to the students, caring, and creative. We think that society, through schools, aims to develop in children those qualities considered socially acceptable. The role of the school in shaping the child's personality is determined by the objectives and goals of educational work, as well as the methods and organization of this activity. Typically, society and the state, through educational institutions, strive to achieve their goals and shape individuals who align with the broader societal development objectives.

The Role of the Kindergarten Educator in Personality Formation During Early Childhood

In the early stages of life, children are especially sensitive to environmental influences and the key figures around them. One of the most important figures during this period, we believe, is the kindergarten educator, who plays an irreplaceable role in shaping the child's personality. Through daily interactions, the educator contributes to the child's emotional, social, moral, and cognitive development, helping to build the foundations of their personality. Warmth and sensitivity from the educator create a safe and supportive environment where the child feels accepted and valued. This sense of security is essential for developing self-confidence and emotional stability. Through clear communication and structured activities, the educator promotes the development of language, critical thinking, and problem-solving skills. At the same time, educator models social behaviors such as cooperation, sharing, and respect for others, helping the child build healthy relationships and develop empathy. The role of the educator can go beyond teaching; they are a guide in the formation of the child's character. Through care, positive reinforcement, and personal example, the educator helps the child internalize moral values such as honesty, responsibility, and fairness. These values are naturally absorbed in an environment where the educator is committed and enthusiastic about their role. As Essa (2019) emphasizes, in her book Introduction to Early Childhood Education (7th ed.), the kindergarten educator influences the holistic development of the child, shaping not only academic skills but also the personality structure that will accompany the child throughout life. Therefore, the role of the educator should not be seen merely as a profession, but as a mission that requires dedication, sensitivity, and a clear vision for the child's future. According to a recent study by Ata and Kimzan (2024), the educator's personality, especially traits such as warmth, sensitivity, and clarity, has a direct impact on the quality of relationships they build with children. These relationships are fundamental for developing self-confidence, a sense of belonging, and prosocial behavior in children. Educators who create a safe and supportive environment help children manage emotions, build healthy relationships, and develop a strong sense of self. The study also draws on attachment theory, which emphasizes that early bonds with caregivers form the foundation of a child's personality. Through daily interactions, the educator models behaviors, values, and attitudes that children naturally adopt. This influences how they perceive.

The influence of the teacher on the formation of the student's personality

The formation of the personality of children is a complex process that is influenced by many factors, where the role of the teacher occupies a special place. The teacher is not simply a transmitter of knowledge, but a modeling figure that influences the intellectual, emotional, social, and moral development of the child. By creating a rich and diverse environment, the teacher helps children develop self-confidence and form a stable identity. Through various teaching methods and techniques, he must encourage critical thinking, exploratory thinking, and develop problem-solving skills. Researchers believe that the key to the success of the teacher in relation to the proper formation of the student's personality is found in the characteristics of the teacher, namely: knowledge, organization and clarity, warmth, and enthusiasm. (Musai, 1999).

• Knowledge - Teachers who are more knowledgeable about their subject have a positive impact on their students.

• Organization and clarity - Clarity in communication and classroom organization avoids uncertainty and helps students build healthy self-esteem. According to the author, when teachers are clear and provide structured instructions, students develop a stronger sense of control over their learning and improve their academic self-confidence. This model is based on the self-system theory and suggests that teacher clarity and organization not only affect academic performance but also shape the personality of the student by building self-esteem and intrinsic motivation.

• Warmth and enthusiasm – warmth, friendliness, and understanding of the teacher are traits that are most strongly linked to students' attitudes towards the subject. In other words, teachers who are warm and friendly tend to have students and the class as their own.

The study by Burić, Butković, and Kim (2023) shows that teacher warmth and enthusiasm are closely related to students' positive perceptions of the quality of teaching. Teachers who display enthusiasm and warm attitudes create a safe and supportive environment, which helps to develop self-confidence, intrinsic motivation, and a sense of belonging in students. These elements are essential for the formation of personality, especially in the early stages of social and emotional development. Thus, the personal and professional characteristics of teachers and educators play an essential role in the development of students' personalities. The teacher's knowledge provides authority and credibility, helping students develop respect for knowledge and form positive attitudes towards learning. Clarity in communication and instruction helps to build self-confidence and a sense of competence, making students more independent and confident in decision-making. Warmth, on the other hand, creates an emotionally safe environment where students feel accepted and valued, which positively impacts the development of empathy, self-esteem, and emotional stability.

The Role of Peers in Personality Formation

Among the most important social factors influencing personality development are peers, children of the same age and with similar interests. Peers are not only classmates or schoolmates, but also children of similar age with whom close relationships are formed. It is important to highlight that in today's world, online games have become a common space where children interact with unknown peers, forming close and influential relationships that affect their behavior, demonstrating that peer influence extends into digital environments. In early childhood, interactions with other children play a key role in emotional, social, and moral development. Recent international research emphasizes that through play, cooperation, and conflict resolution, children learn to build their identity and develop essential life skills. According to Ridgway, Quiñones, and Li (2020), early peer relationships are fundamental for developing empathy, sharing, negotiation, and respect for social rules. Through imaginative and cooperative play, children learn to understand others' feelings and build stable relationships. This process helps shape self-esteem and a sense of belonging, directly influencing personality structure. In the digital age, online games have become an inseparable part of children's lives. Through platforms like Roblox, Fortnite, Minecraft, and others, children not only entertain themselves but also build relationships with unknown peers from different countries. While this phenomenon offers social and technological benefits, it also has sensitive implications for personality development. First, virtual communication with strangers can affect the development of self-esteem and social identity. In environments where feedback is immediate and often unstable, children may become dependent on virtual approval, negatively impacting their self-perception. Moreover, online friendships often lack emotional depth, which may hinder the development of empathy and sincere interaction skills. According to a recent international report by Save the Children and Western Sydney University (2024), over 66% of children with internet access communicate daily with strangers through games and social platforms. While this interaction is often driven by fun and friendship, it carries risks for personality development. Children may be exposed to cyberbullying, emotional manipulation, or digital abuse, which can harm their self-esteem, sense of safety, and moral development. However, the report suggests that digital education and parental awareness can play a protective role. Children who receive clear guidance on online safety and emotional support from their families are better equipped to recognize risks and build healthy relationships, both virtual and real.

The Role of Social Media in Shaping Children's Personality

In the digital age, social media has become an inseparable part of daily life, especially for youth and children. Platforms such as Instagram, TikTok, Facebook, and Snapchat are no longer just tools for communication; they are spaces where individuals construct identity, express themselves, and interact with the world. This widespread influence has brought significant changes in how personality is formed and developed. First, social media affects self-esteem and self-perception. Young people often compare themselves to the idealized images and lives presented on social networks, which can lead to insecurity, anxiety, and feelings of inferiority. Secondly, social media influences the development of values and attitudes. Through the content they consume, young people form opinions about morality, success, beauty, and relationships. Algorithms that promote certain content can limit perspective and create a filtered reality, affecting how an individual sees the world and themselves in it.

According to the U.S. Department of Health and Human Services (2022), social media plays a role in the development of social skills. Virtual interactions can help build connections, but they often replace face-to-face communication, affecting the ability to form deep and authentic relationships. The early use of platforms like YouTube, TikTok, Instagram, and Snapchat by young children has raised serious concerns regarding their impact on personality development. During the early stages of development, children are particularly sensitive to external stimuli. Social media, through its fast-paced and often filtered content, can influence how children perceive themselves, others, and social values. According to a study by Cambridge Judge Business School (2024), early use of smartphones and digital platforms is associated with increased impulsivity and difficulty in decision-making, especially in girls.

Conclusion

In conclusion, this paper affirms that social factors play a fundamental and irreplaceable role in shaping children's personality. From the earliest interactions with family members to the influence of educational institutions, peers, and social media, the child constructs their identity through daily experiences and behavioral models that are observed and internalized. The theories explored by Giddings' Socialization Theory, Erikson's Psychosocial Development Theory, and Bandura's Social Learning Theory offer strong frameworks for understanding how social interactions contribute to the development of self-awareness, self-esteem, empathy, and behavioral patterns. These theories confirm that personality is a dynamic formation that evolves within the context of relationships and cultural experiences throughout life. Educational institutions such as kindergartens and schools are not merely places of learning, but environments where children learn to coexist, share, respect, and build healthy relationships. The role of educators and teachers is crucial in modeling behavior and fostering emotional and moral development. Likewise, peers and digital environments influence the formation of attitudes, social awareness, and a sense of belonging, making personality a reflection of the many interactions a child experiences. In the digital era, social media and online gaming present new challenges and opportunities for personality development. While these platforms offer spaces for self-expression and connection, they also require responsible use, supervision, and continuous education to ensure healthy emotional and social growth. Therefore, the impact of social factors on children's personality formation cannot be underestimated. It is a continuous, interconnected process, shaped by the quality of relationships a child builds with others. Support, warmth, clarity, and positive role models are the elements that help children become the best version of themselves, emotionally stable, socially aware, and intellectually independent.

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Ethics statement: In this study, we declare that the rules stated in the Higher Education Institutions Scientific Research and Publication Ethics Directive are complied with and that we do not take any of the actions based on Actions Against Scientific Research and Publication Ethics. At the same time, we declare that there is no conflict of interest between the authors, who all contribute to the study, and that all the responsibility belongs to the article authors in case of any ethical violations.

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Generative Artificial Intelligence Statement: During the writing of this scientific paper, in addition to the literature we had, we also conducted research through AI, using ChatGPT, to obtain information on how and where we can find literature and information sources for the issues addressed in this paper. From the application, we asked for links to the information sources, and we also searched for them directly on Google and Google Chrome, with the aim of finding the exact source of the information.

Information we obtained from ChatGPT:

- The online book by F.H. Giddings, "The Elements of Sociology".

- The publication of Bouchrika, “Applying Bandura’s social learning theory in digital interdisciplinary education”.

- The online book of Essa, E. L. (2019). Introduction to Early Childhood Education (7th ed.)

- We have been given the link where we can read this article: U.S. Department of Health and Human Services. (2022). Social media has both positive and negative impacts on children and adolescents. In Social media and youth mental health: The U.S. Surgeon General’s Advisory.

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The Role of Pedagogical Factors in Learning Outcomes in Kosovo Primary Schools

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Abstract

Primary education represents a critical stage in which the foundations of students' knowledge, skills, and attitudes are formed. Academic achievement at this level is not determined solely by individual abilities but is strongly influenced by pedagogical factors that shape the teaching and learning process. This study aims to identify key pedagogical factors affecting the educational achievements of students from grades 1–5 in the Republic of Kosovo and to explore the experiences, challenges, and professional needs of teachers. A qualitative research design was employed, involving semi-structured interviews with 12 primary school teachers in the Municipality of Gjilan. The findings indicate that teaching quality, assessment practices, use of technology, family support, and school environment significantly affect students' performance, motivation, and emotional well-being. The results highlight the interdependence of pedagogical and personal factors and emphasize the need for supportive classroom climates and continuous professional development to enhance learning outcomes.

Keywords: pedagogical factors, primary education, teachers

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Introduction

Primary education is the foundation on which the future of every individual and society is built. In the Republic of Kosovo, the educational achievements of students from grade 1 to grade 5 are the result of a complex combination of sociological and pedagogical factors. In the above literature review, in the international context, we come across research conducted by various authors, who speak about the connection between pedagogical and sociological factors in the educational achievements of students. In this early period of education, basic learning skills are formed, motivation develops and the first social and academic relationships are built. However, many students face difficulties that hinder their academic success and their full development.

Sociological factors, such as the socio-economic status of the family, the level of education of parents and social support from peers, often play a decisive role in the opportunities that students have to learn. On the other hand, pedagogical factors, such as teachers' professional preparation, teaching methods and technology used in the classroom, influence the way students acquire new knowledge and skills. In this context, there is a need to understand more deeply how these factors interact with each other and affect students' educational achievements.

This study aims to explore this complex interaction and to analyze the challenges and experiences of teachers in educational settings. Through a combined quantitative and qualitative approach, the study seeks to identify the points where interventions and improvements can make the biggest difference to ensure that every student has the opportunity to reach his or her full potential.

The environment in which the student occurs plays an important role. Factors such as technology, the social environment and material conditions can have an impact on the student's ability to learn. Theoretical studies should also consider how education is integrated into current society and how it adapts to the needs and challenges of today.

The findings of this research are expected to have a significant impact on improving the education system in Kosovo. They will help policymakers design more equitable and inclusive policies for students from grades 1 to 5, addressing socio-economic and pedagogical challenges.

The study will support teachers with recommendations for professional development and the effective use of new teaching methods. It will also highlight the need for greater support for families in need and promote collaboration between schools, parents and the community to ensure the academic success and emotional well-being of every student.

A large number of authors have given their opinions regarding the connection of pedagogy with the field of sociology, which includes several factors that affect the academic performance of students. Although there are different theoretical perspectives that explain the learning process, three of the perspectives, considered for a long time as the most valuable in the field of education, are the behaviorist, cognitive, constructivist and social constructivist theories.

These perspectives are often used in combined ways in teaching practices to determine a richer and more appropriate approach to the different needs of students. Education can be described as an interactive process that promotes deep and continuous interaction between individuals through collaboration. This process enables individuals to learn and develop new knowledge and skills, empowering them to progress in all aspects of their lives. Students' educational achievements are influenced by the interaction between sociological and pedagogical factors. Sociological factors include the social, family and cultural environment, while pedagogical factors are related to the quality of teaching and educational practices. The balance between these factors is essential to promote student success and development.

Thus, to create a successful educational environment, students' educational achievements and their learning process are key factors (Bonsaksen, Brown, Lim dhe Fong , 2017). Bonsaksen, emphasize that one of the most important aspects that should be taken into account is the way students learn and their learning outcomes. In addition, it is important to assess the role of other components that influence educational outcomes, such as the professional preparation of teachers, the curriculum and its implementation, educational policies and the state of parents.

Based on these theoretical perspectives mentioned above, learning interacts with the motivation of students to acquire new knowledge, but at the same time it also depends on pedagogical factors, more precisely the way in which knowledge is organized and transferred to students (Berliner, 1993). According to behaviorists, knowledge contains the repertoire of behaviors that react depending on environmental stimuli. While, based on the cognitive constructivist perspective, knowledge is organized into cognitive structures and is built based on existing cognitive structures (Perry, 1999).

Whereas, the social constructivist approach explains knowledge as processes constructed depending on the social context through interactions with knowledge from the environment. (Vygotsky Govrain, 1978).

In general, there are several theoretical perspectives that explain the interaction of motivation with learning and the process of acquiring new knowledge in students. These perspectives often include psychological, sociological, and pedagogical aspects. According to the behaviorist approach, knowledge and learning are stimulated by positive or negative reinforcement; the cognitive constructivist approach considers that the level of learning is the result of the students' goals and the way they motivate themselves to learn; while according to the social constructivist approach, the motivation process is related to the two previous approaches, where the goals and motives for learning are determined by the students but they are influenced by the reinforcements of the leaders and the environment in which they live (Berliner, 1993). According to the behaviorist approach, knowledge and learning are promoted by positive or negative reinforcement. While the cognitive constructivist approach emphasizes that the level of learning is the result of students' goals and their way of self-motivation. Despite the fact that there have been attempts to include all students in the learning process (Syla, 2022) It can be explored how these efforts have been reflected in theory and practice and how they can be improved to achieve better inclusion.

The Influence of Sociological Factors on Educational Achievement is multifaceted and affects student success in various ways. Family, socioeconomic status, cultural environment, and peer support play an important role in shaping attitudes toward education and motivation to learn. On the other hand, lack of support or economic challenges can create barriers to educational progress. Also, community norms and values influence students' perceptions of schooling.

For this reason, a comprehensive approach that supports sociological development is essential for educational success. Research shows that poverty, which is a socio-economic variable, causes inequality in outcomes between individuals in the educational environment. From another perspective, schools that cater to students from economically disadvantaged families differ from schools with higher standards in terms of high educational performance.

These schools often face multiple challenges, including a lack of sufficient educational resources, inadequate infrastructure, and a lack of psychological and social support for students. Students from economically disadvantaged families often face additional challenges such as lack of access to books and school materials, inadequate nutrition, and insecure housing. To address these disparities, it is necessary to implement a comprehensive approach that includes financial support for families, improving school infrastructure, and developing programs that provide social and psychological support for students. In order to achieve high educational performance for all students, it is important to create policies and strategies that address these disparities. This includes investing in education, providing ongoing training for teachers, and developing support programs for families with economically disadvantaged families. Only through these joint efforts can we create an educational environment where every student has the opportunity to reach their full potential.

First of all, teacher professional development is seen as a new and critical field in current educational environments. Research on teacher education is defined as new advances (McDonald & Grossman, 2008) In today's educational world, scientific studies focus on various aspects of teacher education. Teacher programs are interpreted as a basic source of education to improve student achievement standards. Authors such as: (Gansle, K. A., Noell, G. H., & Burns, J. M, 2012) argue that students' achievements are linked to their educational experience that is developed and organized by their teachers while they are in school. Thus, high-level differences across teacher education programs that prepare future teachers or some applications depending on different countries' and institutional rules can be

assessed as critical shortcomings that affect student achievement. Teacher behaviors and characteristics also shape student achievement. This situation can be interpreted as a clear indication of the mutual importance of communication between students and their teachers. According to several scientific studies, the relationship between teacher characteristics and student achievement is seen as important (Wayne, 2003). From another perspective, some scientific studies argue that teachers should always be sensitive, positive, and constructive in the classroom to strengthen their students' achievements.

From this perspective, we emphasize that when the teacher demonstrates empathy and believes in the potential of students, this motivates them to be more engaged, believe in their abilities and achieve higher results. Therefore, the teacher's positive behavior and attitude are not simply pedagogical techniques, but important factors that shape students' academic success and personal development.

Methods

Problem definition

This study examines the impact of sociological and pedagogical factors on the academic achievement of students from grades 1 to 5 in Kosovo. Factors such as family socio-economic conditions, parental education level, teaching quality and assessment methods affect student performance. Challenges such as lack of resources, insufficient support for teachers and limited technology exacerbate the problem. The research aims to reveal how these two categories of factors, pedagogical and sociological, interact and how they can create a positive impact to improve students' educational achievement. This multidisciplinary analysis aims to provide a deep understanding of the challenges and opportunities that can help in designing effective strategies for improving school performance.

Research purpose

The purpose of the research is to understand in depth the sociological and pedagogical factors that influence the educational achievements of students from grades 1 to 5 in the Republic of Kosovo. Through this research, the aim is to identify and analyze the complex connections between the socio-economic conditions of families, the professional preparation of parents, the quality of teaching, assessment methods and the use of technology in the educational process. Also, this study aims to shed light on the experiences, challenges and needs of teachers working with students in primary education. By combining quantitative and qualitative research methods, it is intended to create a complete and comprehensive understanding of the factors that contribute to the success or difficulties of students in the learning process.

This research aims to provide concrete recommendations for improving the quality of education in Kosovo, by identifying the best pedagogical practices and emphasizing the need for greater support for families and teachers. At the end of the study, the results are expected to help policymakers, educational institutions, and the community as a whole to create a fairer, more effective, and more appropriate educational environment for the full development of every student.

Research questions

1.What is the impact of teaching quality on the educational achievements of primary school students in the Municipality of Gjilan?

2.How do assessment methods affect the academic performance of students from grades I–V?

3.In what way does the use of technology contribute to student outcomes and motivation in the learning process?

4.How does family structure and support affect the educational achievements and emotional well-being of primary school students?

5.What are the experiences, challenges, and professional needs of teachers regarding pedagogical factors that influence student success?

6.How do pedagogical factors interact with students' personal factors in shaping motivation, satisfaction, and learning outcomes?

Research hypotheses

H1:High quality teaching has a positive and significant impact on the educational achievements of primary school students.

H2:The use of effective and continuous assessment methods affects the improvement of students' academic performance.

H3:The integration of technology into the teaching process contributes to increasing student motivation and results in primary education.

H4:Stable family support and structure have an important role in students' academic success and emotional well-being.

H5:Primary school teachers face various professional challenges that affect the implementation of pedagogical factors and student results.

H6:The interaction between pedagogical and personal factors of students affects the level of satisfaction, motivation and educational performance.

This research aims to evaluate the role of pedagogical factors in shaping learning achievements in primary education in Kosovo – grades 1–5. The study will be qualitative. The main objective is to understand how pedagogical practices influence students' academic performance and overall development in the lower primary cycle. This study also seeks to explore how teachers experience, implement, and interpret pedagogical factors within real school contexts. The findings are expected to contribute to the formulation of recommendations for improving teaching practices and professional support for teachers.

Sample

The research will focus on the Republic of Kosovo, in 10 schools within the Municipality of Gjilan. These schools have been selected randomly. The respondents of this study will be teachers from the first to the fifth grade (1–5). Thus, the selected sample for this research will consist of N=12 teachers. The selection aims to ensure a diverse representation of pedagogical practices across different schools in the city. This number of participants is sufficient for an in-depth qualitative analysis, enabling the exploration of real experiences and professional perceptions of teachers.

Instrument

With a qualitative character, this research will collect data through a semi-structured interview with 12 teachers. The interview will be semi-structured and consists of 10 questions focusing on the quality of teaching, instructional methods, and the use of technology. This form of data collection allows flexibility, enabling participants to express their experiences and personal evaluations in detail. The questions are designed to reveal concrete practices of pedagogical implementation and the challenges teachers face in the teaching process.

Observation method

The method of classroom observation will be used to directly analyze the impact of teaching methods and the interaction of students with teachers and peers. This method will enable a realistic view of pedagogical practices in natural educational settings. Observation will contribute to the triangulation of data, making the analysis more reliable and comprehensive. Through this process, it is expected that instructional behavior patterns and factors influencing student engagement and motivation will be identified.

Findings

The data collected from participants consistently indicate that pedagogical factors and students' personal characteristics interact in influencing their academic achievement and motivation. Five key domains emerge: effective planning, active teaching methods, differentiated instruction, comprehensive assessment, and an emotionally supportive classroom climate.

First, teachers report that clear planning and an appropriate lesson pace increase student achievement and self-confidence, suggesting that pedagogical organization is a prerequisite for success. Likewise, the use of active teaching methods increases participation, especially among passive students, demonstrating that practical engagement serves as a motivating and inclusive factor. Differentiated instruction also appears as an important indicator of teaching quality, where adapting lessons to different levels and learning styles significantly improves outcomes, particularly for children with learning difficulties.

Regarding assessment, the comments show that relying solely on traditional tests increases anxiety and does not accurately reflect students' competencies. In contrast, projects, portfolios, formative assessment, and rubrics enhance objectivity, self-awareness, and responsibility, supporting the development of diverse skills. The inclusion of self-assessment and peer assessment is seen as a strategy that promotes autonomy and motivation. In the technological dimension, teachers emphasize the positive impact of interactive applications, videos, and online platforms on attention, comprehension, and individual monitoring. However, the lack of technological infrastructure reduces motivation and limits the learning process to a theoretical level, suggesting that technology is effective only when integrated with a pedagogical purpose and used in moderation.

With regard to family support, teachers report that family structure and parental involvement directly affect students' emotional and academic preparation. Families facing socio-economic difficulties encounter barriers in providing support, which is reflected in lower academic performance and challenging behaviors. Regular school-family communication is viewed as a protective factor that increases participation and motivation. At the professional level, teachers identify structural challenges such as large class sizes and limited resources, while the main need remains practical training in contemporary methodologies. Additionally, the demand for psychological support reflects the emotional burden of the profession and points to the need for more sustainable institutional policies.

The analysis shows that pedagogical factors operate interdependently in shaping students' achievement and motivation. The quality of teaching is not determined solely by methodology, but by the combination of effective planning, differentiation, comprehensive assessment, and an emotionally supportive classroom climate. Technology and family collaboration play complementary roles, while teachers' professional development remains essential for implementing advanced practices. These findings suggest a holistic approach to the teaching process, where the interplay of pedagogical and personal factors creates a sustained impact on student success in primary education.

Table 1.
Table of interviewed teachers

Participant No	Gender	Age	Work eksperience	Code
P1	Female	49 years	12 Years	L1-F-20
P2	Female	52 Years	15 Years	L2-F-23
P3	Female	38 Years	10 Years	L3-F-33
P4	Female	29 Years	3 years	L4-F-40
P5	Female	40 Years	7 Years	L5-F-42
P6	Female	26 Years	2 Years	L6-F-47
P7	Male	44 Years	8 Years	L7-M-50
P8	Female	59 Years	18 Years	L8-F-54
P9	Female	32 Years	3 Years	L9-F-57
P10	Female	55 years	9 years	L10-F-59
P11	Male	27 Years	1 years	L11-F-62
P12	Male	30 Years	2 years	L12-F-65

Table 1. shows the codes used for each participant; for example, P1-P12 refers to P- for teachers, 1 - for counting participants; F/M – gender, age, L1 codes.

In this section, we present the results of the qualitative research. The research was conducted through interviews with 10 teachers of grades one to five (1-5).

The teachers stated that:

Impact of teaching quality

“When planning is clear and the lesson progresses at an appropriate pace, students achieve higher results and feel more confident in their school tasks.” (Participant 1, 9, 12, 4, 6).

“The use of active teaching methods increases participation and motivation, especially among students who usually remain passive in class.” (Participant 4, 8, 10, 3, 6).

“The quality of teaching is reflected in the ability to differentiate instruction. When adapted to different levels, student achievements improve significantly.” (Participant 5, 9, 12, 7, 8).

“Regular and immediate feedback helps students understand their mistakes and develop more effective learning strategies.” (Participant 1, 9, 4, 2, 6).

“A calm and supportive classroom environment created by the teacher has a direct impact on students’ emotional security and academic success.” (Participant 4, 9, 10, 2, 6).

These comments clearly indicate that the quality of teaching is closely linked to five key elements: effective planning, active teaching methods, differentiation, regular feedback, and a supportive classroom climate. Participants emphasize that these strategies increase student motivation, self-confidence, and participation, directly influencing academic achievement. Teachers’ experiences show that the emotional environment is just as important as instructional techniques, suggesting a holistic approach to the teaching process. This analysis highlights that pedagogical factors operate interdependently, creating a sustained impact on student success.

Effect of assessment methods

“When only traditional tests are used, students experience anxiety and the results do not always reflect their real knowledge.” (Participant 3, 9, 1, 2,).

“Assessment through projects and portfolios helps students demonstrate skills that do not appear in regular testing.” (Participant 4, 8, 10, 7, 5).

“Continuous formative assessment allows me to correct mistakes during the process, not only at the end of the learning unit.” (Participant 4, 9, 10, 2, 6).

“Clear rubrics increase objectivity and make students more aware of achievement standards.” (Participant 2, 9, 10).

“When I include self-assessment and peer assessment, students become more responsible and more motivated.” (Participant 12, 8, 4, 2, 6, 7, 9).

Teachers emphasize that relying solely on traditional testing limits assessment and increases anxiety among students, failing to reflect their actual abilities. They value alternative methods such as projects, portfolios, rubrics, and formative assessment because these approaches enhance objectivity, responsibility, and students’ awareness of achievement standards. The analysis suggests a more comprehensive assessment approach that supports motivation and the development of diverse student skills.

Use of technology in outcomes and motivation

“The use of interactive applications increases attention and makes learning more understandable for visual learners.” (Participant 1, 3, 4, 12, 6, 7, 9).

“In situations where technological infrastructure is lacking, motivation decreases and lessons remain only theoretical.” (Participant 12, 9).

“Videos and simulations help greatly in explaining difficult concepts, especially in natural science subjects.” (Participant 6, 7, 9).

"When technology is used in moderation and not only for entertainment, students develop critical thinking skills and creativity." (Participant 2, 6, 4, 3, 6, 7, 12).

"Online platforms have helped me monitor individual progress, especially after missed lessons." (Participant 12, 8, 4).

The interviewed teachers indicate that technology has a positive impact on students' attention, comprehension, and cognitive skill development, especially when used in a balanced manner. They emphasize that the lack of technological infrastructure reduces motivation and limits learning to a theoretical level. The main benefits are linked to the personalization of learning and the support of individual progress through online platforms.

Influence of family structure and support

"Students who receive regular support at home come to school better prepared and with less anxiety." (Participant 1, 6, 4, 3, 6, 7, 12).

"Lack of family structure often reflects in challenging behavior and difficulty concentrating." (Participant 4, 6, 1, 3, 6, 8, 12).

"When parents cooperate with the teacher, progress is more visible and sustainable." (Participant 3, 6, 4, 9, 6, 7, 1).

"Families facing socio-economic difficulties often struggle to support children with school tasks, which affects their results." (Participant 1, 6, 7, 12).

"Regular communication with parents has increased student motivation and their active participation in class." (Participant 10, 4, 4, 3, 9, 7, 12).

Teachers' experiences, challenges, and professional needs

"The greatest needs are related to practical training rather than theory, especially in modern teaching methodologies." (Participant 4, 6, 12).

"One of the main challenges is the high number of students in the classroom, which makes differentiation difficult." (Participant 1, 2, 10, 3, 7, 8, 12).

"The lack of teaching resources often forces us to improvise, reducing the quality of instruction." (Participant 9, 4, 1, 2, 7, 8, 10).

"My experience has shown that collaboration among colleagues greatly facilitates planning and overcoming challenges." (Participant 3, 2, 1, 4, 10, 9,).

"Teachers need more psychological support for managing student behavior and emotional workload." (Participant 1, 9, 2, 3, 6, 8, 12).

These comments show that teachers face both structural and professional challenges, where the lack of practical training and instructional resources directly affects the quality of teaching. The high number of students in the classroom makes differentiation and individual support difficult, increasing pressure on teachers. Participants emphasize the importance of collaboration among colleagues as a practical strategy for overcoming difficulties. Additionally, the need for psychological support reflects the emotional burden of the profession and highlights the necessity for supportive institutional policies.

Interaction between pedagogical and personal student factors

"Students' intrinsic motivation increases when learning is connected to their interests and personal experiences." (Participant 4, 6, 1, 3, 6, 8, 12).

"Students with learning difficulties respond more positively to visual methods and practical activities." (Participant 4, 6, 1, 3, 6, 8, 12).

"When the teacher understands the student's individual learning style, achievements improve significantly." (Participant 4, 6, 1, 3, 6, 8, 12).

"The emotional climate in the classroom is just as important as the method; fear reduces performance and participation." (Participant 4, 6, 1, 3, 6, 8, 12).

"Constructive feedback and moderate praise increase self-confidence and motivation in more sensitive students." (Participant 4, 6, 1, 3, 6, 8, 12).

The participants' statements clearly highlight that students' academic success is directly linked to the personalization of the learning process. First, intrinsic motivation increases when learning is connected to students' interests and personal experiences, suggesting that standardized approaches do not work equally for all learners. The participants emphasize that students with learning difficulties respond more positively to visual methods and practical activities, indicating the importance of differentiation and multisensory teaching. In addition, when teachers understand students' individual learning styles, academic achievement improves significantly, shifting the teacher's role from a knowledge transmitter to a pedagogical guide.

Another important element is the emotional climate in the classroom, where fear reduces participation and performance, confirming that the socio-emotional dimension is just as essential as instructional methods. Finally, constructive feedback and moderate praise increase self-confidence, especially among more sensitive students, highlighting that motivation is built not only through knowledge, but also through psychological support. Overall, the analysis suggests that personalized pedagogy, a positive classroom climate, and differentiated approaches are key factors that positively influence student motivation and learning outcomes in primary education.

Discussion

This research provided an in-depth examination of the relationship between sociological and pedagogical factors influencing the educational development of students in grades 1–5 in the Republic of Kosovo. The findings revealed that elements such as the family's economic situation, parents' educational background, the quality of teaching practices, assessment approaches, and the use of technological tools play a significant role in students' academic outcomes.

Previous literature highlights the importance of systematic collaboration between parents and teachers as an essential component for improving student performance. Regular communication enables parents to stay informed about their children's progress and challenges, while also creating opportunities for mutual support within the educational process (Epstein, 2001). A later study confirmed that teachers who maintain consistent meetings and structured reporting with parents are more likely to enhance student participation and engagement (Sanders, G., , & B, 2002). The results also showed that teachers' professional experience and age are associated with how they conceptualize and implement instructional practices. These findings align with research suggesting that novice and experienced teachers demonstrate different teaching styles and attitudes toward technology use and parental collaboration (Shulman, 1987). (Darling-Hammond, 2000) argues that experienced teachers develop more consistent pedagogical practices, possess higher competencies in classroom management, and demonstrate greater flexibility in adapting teaching methods to student's needs. In addition, the analysis emphasized the influence of socio-economic status on students' emotional well-being and academic results, consistent with studies indicating that teachers are aware of this factor as a major determinant of educational achievement (Hargreaves, 2003). Another key finding relates to the higher level of technology use among younger teachers, which supports existing research showing that this group tends to be more receptive to digital tools and innovation in instructional processes (Ertmer, 2005). The integration of modern assessment practices and technology was found to positively affect student motivation and engagement, encouraging higher levels of academic success.

The use of diverse assessment methods—such as projects, creative tasks, and various testing formats—is confirmed in pedagogical literature as an effective way to increase students' active interaction with learning content (Mueller & Parcel, 1981). These practices provide broader opportunities to evaluate students' competencies and enable them to demonstrate their skills in multiple ways. (Hattie & Timperley, 2007) emphasize that varied assessment strategies, including creative and collaborative forms, have a direct impact on improving academic outcomes, fostering greater confidence and motivation to progress in learning.

Conclusion

This study provides an in-depth understanding of the role that pedagogical factors play in shaping students' learning achievements in primary education in Kosovo (grades 1–5). The findings show that academic success does not depend solely on students' individual abilities, but is constructed through a multidimensional interaction between the quality of teaching, assessment methods, the use of technology, and overall school conditions. Teachers identified five key elements that directly influence student outcomes: effective planning, active teaching methods, differentiation, comprehensive assessment, and an emotionally supportive classroom climate.

The results also highlight that sociological factors such as family structure, socio-economic status, and parental involvement have a direct impact on students' emotional and academic preparation. Regular communication between school and family emerges as a protective mechanism that increases participation, motivation, and children's well-being. Conversely, lack of family support and economic difficulties are associated with lower performance and more challenging behaviours.

The use of technology was identified as a complementary factor that enhances attention, motivation, and understanding, but its effectiveness depends on adequate infrastructure and pedagogical integration, rather than merely on the presence of digital tools. The need for continuous professional development particularly in contemporary methodologies and emotional management was emphasized by the majority of teachers, indicating the structural challenges within the education system. In conclusion, the study suggests that improving student achievement requires an integrated approach that combines the strengthening of pedagogical practices, supporting families, and creating an equitable and inclusive school environment. Education policies should focus on investment in infrastructure, practical training for teachers, strengthening school–family collaboration, and ensuring support resources for students from vulnerable backgrounds. Only through these coordinated interventions is it possible to ensure that every student has the opportunity to reach his or her full potential in primary education in Kosovo.

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Strength Abilities in Some Auxiliary Exercises as Predictive Factors for Bench Press Results of Competitive Powerlifters

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Abstract

Introduction. In this article, the authors studied the relationships between some specific auxiliary powerlifting exercises and maximal force generated in two classic multi-joint resistance exercises – back squat and deadlift. Subjects were male competitive powerlifters. Literature review. Besides the strictly sport-specific movements – squat, bench press and deadlift – powerlifters use specific auxiliary resistance exercises to develop maximal and/or explosive strength. The competitive exercises are technically complex and require the development of the so-called maximal strength and strength-speed abilities. Irrespective of the fact that training methodologies in powerlifting do not differ much among different training schools, the strength abilities and physical development of athletes of similar qualification may vary significantly. Method. 17 athletes participated in the study, all of them competitors at the national level. Linear regression equations were estimated between estimated 1RMs in four auxiliary powerlifting exercises (weighted hyperextensions, weighted reverse hyperextensions, belt squat and box-squat) and maximal strength in back squat and deadlift. Findings. We calculated statistically significant Pearson correlation coefficients and coefficients of linear regression between the performance in the studied auxiliary exercises and maximal muscle strength in back squat and deadlift. Discussion, conclusion and suggestions. The studied parameters proved to be statistically significant predictors of maximal strength in the deadlift and squat. These results (in conjunction with the high values of adjusted R squared of the regressions) indicate that the constructed statistical models explain a relatively high proportion of the variation in the results. These findings can be used in training practice as guidelines for training changes to improve sports performance.

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Introduction

People have habitually used resistance exercises since ancient times. Ancient Egyptians, Romans, and Greeks regularly trained with heavy weights to develop muscle strength and build an athletic body appearance. Various artefacts from Ancient Greece depict men doing resistance exercises – initially using stones and later, dumbbells. These stones were specially carved for easy handling and lifting. A very interesting artefact, the so-called Bybon stone, weighting 143.5 kg, was found at the Ancient Olympia site. It has a carved hand grip and an inscription on it. According to the legend, the famous weightlifter Bybon used to lift it overhead singlehandedly. Another legendary Ancient Greek also used weights for increasing his strength – the wrestler Milo of Croton. He carried a calf on his shoulders and as the calf grew bigger over time, Milo grew stronger. In fact, Milo's experience is the first "officially" documented training and periodization methodology for the sport. Exercises with weights were also present in the program of the early Olympic Games for both competition and strength training (1). Olympic weightlifting was included in the program of the first modern Olympic Games in 1896. It was designated as an individual sports discipline in 1920. Powerlifting naturally evolved from Olympic weightlifting as a separate sport at the end of the XIX century. The first official powerlifting tournament with modern-time rules took place in 1965. The International Powerlifting Federation was founded in 1973 and the first World Championships took place the same year. The European Powerlifting Federation was founded the next year and since then official World and European Championships have been organized annually.

Literature Review

The competitive exercises in powerlifting are three: squat, bench press and deadlift. Additionally, many auxiliary exercises are used for improving maximal strength on these movements. There are studies that find relationships between strength in auxiliary exercises and results in the completive movements (2, 3, 4, 5). In Olympic weightlifting researchers have reached even further: linear and parabolic regression equations were derived and successfully applied in practice to improve performance (6, 7). Based on these, normative tables were developed (and implemented in training) to help coaches decide which auxiliary exercises should be emphasized in order to improve results in competitive movements. For example, they provide information about how much an athlete should squat to clean and jerk a certain weight. Bulgarian coaches have routinely used these equations for decades.

To our knowledge, such linear regression equations have not been derived and applied in practice in powerlifting. For that reason, in this article, we explored the relationships between some of the most popular auxiliary exercises in powerlifting and maximal strength in one of the competitive movements – the bench press. The aim of the study was to quantify these interrelations in order to make them applicable for use by coaches in training and sports selection in powerlifting.

Method

We used the following tests to measure the maximal strength in the bench press (in accordance to the IPF technical rules) (8):

1. The subject must lie on his back with head, shoulders, and buttocks in contact with the bench surface.
2. The feet must be flat on the floor (as flat as the shape of the shoe will allow).
3. The hands and fingers grip the bar positioned in the rack stands with a thumb around grip.
4. The position is maintained throughout the lift. Foot movement is permissible but must remain flat on the platform.
5. The spacing of the hands shall not exceed 81 cm measured between the forefingers.
6. The subject must lower the bar to the chest or abdominal area whereby the underside of both elbow joints is lowered level with or below the top surface of each respective shoulder joint and hold it motionless.
7. The subject must then return the bar to straight arms' length elbows locked.

We modified the Comfort & McMahon, 2015 protocol for measuring maximal strength (estimating 1 repetition maximum/RM). It is relatively easy to perform, has high statistical reliability and is suitable for experienced athletes (9):

Participants warmed up by performing the exercises with submaximal loads that they were accustomed to from their normal training. Participants were permitted a maximum of 6 progressively increasing loads, for each exercise, although all participants completed the testing within 4–5 attempts. Weight was increased in increments of between 5 and 20 kg starting with larger increments and gradually decreasing them until the maximum was reached.

We estimated maximal strength abilities in the following auxiliary exercises that are wide used in sports preparation in powerlifting:

1. Wide grip bench press – as wide as the subject can support;
2. Close grip bench press – the grip is maximum 60 cm wide;
3. Board press – the board is 6 cm high;
4. Pin press – the pin is placed at about 20 cm higher than the chest – around the sticking area of the movement.

We used the Epley, 1985 formula to estimate maximal strength based on the number of successful repetitions in each auxiliary exercise (10).

$$\mathbf{1RM = W \times (1 + R / 30),}$$

where W is the weight lifted (in kilograms) and R is the number of repetitions performed.

We used the following statistical methods to interpret the results of the study:

- Variation analysis. The following parameters were calculated: mean value, standard deviation, minimum value and maximum value.
- Correlation analysis. We studied the relationships between the measured variables by calculating Pearson correlation coefficients at a level of significance of $p<0.05$. (12).
- Stepwise regression analysis. A stepwise regression analysis was performed with a forward linear regression approach to estimate the value of the studied variables as predictors of each of the maximal strength tests (11, 12).

All statistical analyses were conducted using IBM SPSS Statistics for Mac (version 26).

The contingent of the study consisted of 17 powerlifters with a competitive experience at National level aged 21.29 □ 2.97 years. Of them 13 were male and 4 were female. They covered all weight classes in powerlifting – the body mass of participants ranged between 47 and 124 kg, 93 □ 2.69 kg on average.

Findings

Table 1

Variation analysis of obtained data

	Minimum	Maximum	Mean	Std. Deviation	K-S test
Wide grip bench	51	191	126.882	45.971	0.915
Close grip bench	37	168	112.471	46.683	0.75
Board press	57	213	140.059	50.845	0.956
Pin press	49	225	146.765	57.719	0.836

Bench press	55	185	125.941	44.203	0.814

Table 1 represents the variation analysis of our results. We also performed a test for normality of the data (the Kolmogorov-Smirnov test) as this is one of the requirements for the Pearson correlation procedure. As shown in the table, we can reject the hypothesis of non-normal distribution for all variables. The Pearson linear correlation coefficients are presented in Table 2. The calculated coefficients are statistically significant for all studied auxiliary exercises. These findings are not unexpected as all analysed exercises are similar in biomechanical structure. Furthermore, they are strongly correlated – the values of Pearson correlation coefficients are high and statistically significant.

Table 2

Correlation matrix of studied variables for the bench press

	Wide grip bench	Close grip bench	Board press	Pin press	Bench press
Wide grip bench	-				
Close grip bench	0.971*				
Board press	0.986*	0.953*			
Pin press	0.982*	0.982*	0.993*		
Bench press	0.993*	0.981*	0.988*	0.979*	-

Statistically significant correlations ($p<0.05$) are marked with *

The models of linear regression for the studied strength tests are presented in Table 3. Model parameters are statistically significant for all four auxiliary exercises with the exception of the constants for the wide grip bench press and board press. In addition, the explained variance of all models (R-squared) is very high, which indicates that they achieve a good fit to the data and explain the relationships between studied variables. Most probably, all estimated parameters would reach statistical significance if the studied sample size was increased.

Table 3

Linear regression models of studied variables vs. Squat

Model		Unstandardized Coefficients		t	Sig.	R Squared
		B	Std. Error			
Bench press	Constant	4.788	3.934	1.220	0.242	0.986
	Wide grip bench press	0.955	0.029	32.640	<0.001	
Bench press	Constant	21.511	5.808	3.700	0.002	0.962
	Close grip bench press	0.929	0.047	19.380	<0.001	
Bench press	Constant	5.639	5.144	1.100	0.290	0.976
	Board press	0.859	0.035	24.790	<0.001	
Bench press	Constant	15.859	6.271	2.530	0.023	0.959

Discussion, Conclusion, and Suggestions

In all sports with weigh classes (powerlifting included) athletes aim at increasing their (maximal) strength abilities without gaining excessive body weight (2). On the other hand, it is quite difficult to achieve only myofibrillar hypertrophy and maintain body weight within a certain range (13, 14, 15).

One of the goals of implementing auxiliary exercises in powerlifting is to build additional strength in the competitive movements without accumulating much additional muscle mass and to keep the body weight stable (4, 5, 16). Not many authors have tried to quantify the relationships between results in auxiliary exercises and performance in strength sports and logically, no systemized unanimous opinions and conclusions on the topic exist among the scientific community. The statistically significant relationships between auxiliary exercises and results in bench press are not unexpected as they are similar in biomechanical structure and engaged muscles. However, quantifying these relationships (as in our study) makes them useful and valuable in training practice.

Gonchar, 2025 studied the effects of auxiliary exercises on bench press results in young powerlifters (17). The author concluded that improved special physical fitness is a factor of bench press performance. To achieve this goal, athletes should implement “variable resistance tools”, i. e. auxiliary exercises. In contrast to our study, however, the author only proved their efficiency, but did not arrive to any quantifiable dependencies.

Leutko, 2017 studied the effects of different auxiliary exercises on overcoming the so called “sticking points” in the bench press (18). The author analysed several movements commonly used in bench press training in powerlifting. However, the focus of the research was at the overall effect of an experimental training methodology and not at separate auxiliary exercises. Accordingly, no quantitative relationships were sought and found.

Semko et al., 2021 studied the effects of auxiliary exercises with rubber bands on strength abilities in competitive movements in highly qualified powerlifters (19). These authors also did not access quantitatively the relationships between strength in auxiliary and competitive exercises. They concluded that rubber band exercises are useful tools in the preparatory period of experienced powerlifters for increasing strength in competitive movements. In contrast to our study, they used classic competitive movements performed with elastic bands as auxiliary exercises.

In their systematic review, Ferland & Comtois, 2019 analyzed the most widely used training routines in classic powerlifting (20). The only auxiliary exercise they studied was bench press with sling shot. Their findings, however, cannot be directly compared to ours as no quantitative relationships were calculated. Nevertheless, the authors reported a superiority of a methodology that includes sling shot bench press as an auxiliary exercise for increasing the results in the bench press. In this regard, similar to our results, they found that the inclusion of some auxiliary exercises beneficial for overall sports preparation in powerlifting.

The regression models we derived can be of valuable practical use for athletes and coaches in strength sports. They bring information about specific lagging muscles and the auxiliary exercises that can be used to increase their strength abilities and improve results in the bench press. Similar approach based on regression relationships between accessary exercises and sport-specific strength in Olympic weightlifting is also commonly used by the Bulgarian coaches (6, 21, 22). Thereby, our study broadens the set of possible methodological tools that can be applied in strength training. In addition, bench press is used as a test exercise in strength training and conditioning in many sports. This fact expands the potential for application of our findings in sports practice.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Drama as a Reinforcing Technique in Teaching English

Sezgin Kondal[1]

Abstract

This paper examines the role of drama as a reinforcing technique in English language teaching, with particular attention to its effects on linguistic, cognitive, and affective domains. Building on previous research, drama fosters motivation, fluency, adaptability, and communicative competence through embodied and student-centered learning. Recent empirical studies further demonstrate its positive impact on vocabulary acquisition, grammar, listening, speaking, and intercultural understanding. When language is situated within meaningful contexts, drama activities such as role-play, improvisation, and story enactment promote authentic interaction, perspective-taking, and cognitive empathy. These practices enhance retention and communicative spontaneity.

The paper also addresses the increasing integration of technology and artificial intelligence into drama-based pedagogy. Tools such as augmented reality and applications driven by artificial intelligence create immersive and adaptive learning environments. These technologies enhance student participation and broaden the pedagogical scope of drama. Artificial intelligence supports collaborative playwriting, improvisation, and connections between writing and drama. However, challenges remain regarding technical access, teacher preparation, and ethical considerations. In this context, the teacher's role evolves from traditional facilitator to a mediator who combines embodied learning with digital engagement. This shift requires both pedagogical creativity and technological literacy.

Drama continues to serve as an effective method for reinforcing English language learning by integrating emotional engagement with linguistic practice. Integration with emerging technologies provides opportunities for increased interactivity, personalization, and creativity. This study contends that balanced and reflective teacher mediation is necessary to fully realize the benefits of drama and technology in language education.

Keywords: Drama-based learning, English language teaching (ELT), process drama, augmented reality (AR), artificial intelligence (AI)

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Introduction

In recent decades, English language teaching (ELT) has increasingly shifted away from transmission-based approaches toward learner-centered pedagogies that emphasize communication, creativity, and engagement. Within this evolving landscape, drama has emerged as one of the most powerful and holistic methods for facilitating second language acquisition. Far from being limited to theatrical performance, drama in education involves the use of role-play, improvisation, simulation, and process drama as pedagogical strategies that place learners at the center of meaningful action. It integrates linguistic, cognitive, affective, and social dimensions of learning, turning language practice into a dynamic, embodied experience.

The incorporation of drama into ELT draws upon several complementary theoretical perspectives, including constructivist learning theory, Total Physical Response (TPR), and communicative language teaching (CLT). As Davies (1990) emphasizes, drama activities require active learner participation, which strengthens motivation and maturity by linking physical action with linguistic expression. This connection between body and language, sometimes called kinaesthetic learning, facilitates deeper cognitive processing and long-term retention.

Over the years, numerous studies have documented the benefits of drama for language learners. Bessadet (2022) demonstrated that drama fosters growth in physical, emotional, social, and cognitive domains simultaneously, thus promoting comprehensive learner development. Similarly, Wager et al. (2009) highlight how process drama improves communicative competence through structured improvisation and reflection. Uysal and Yavuz (2018) found that drama enhances not only listening and speaking but also reading, writing, grammar, and vocabulary acquisition.

At a deeper pedagogical level, Heathcote's (1991) philosophy of drama in education positions the teacher not as a transmitter of knowledge but as a creator of learning situations. In her view, students should confront challenges through experiential engagement before receiving the teacher's formal input, enabling them to construct meaning actively. This conception of the teacher as a facilitator or co-participant aligns with Vygotsky's (1978) sociocultural theory, where learning occurs through social interaction within the learner's zone of proximal development.

Drama thus serves not merely as a "fun" activity but as an experiential learning framework that engages the learner cognitively, emotionally, and socially. It allows students to embody language, to "live" words rather than memorize them. This essay explores how drama enhances English language learning, focusing on its pedagogical, psychological, and technological dimensions, and concludes by examining the evolving role of the teacher in both traditional and technology-enhanced drama settings.

Drama as Experiential and Communicative Learning

Drama embodies the principles of experiential learning as outlined by Kolb (1984), who argued that learning is a cyclic process involving concrete experience, reflective observation, abstract conceptualization, and active experimentation. In drama, these stages occur naturally: students experience situations through role-play, reflect on their actions, conceptualize linguistic forms and meanings, and then reapply them in subsequent performances.

This iterative process enhances both language accuracy and fluency. Learners must respond spontaneously to peers, negotiate meaning, and adapt to changing communicative contexts, all of which mirror authentic language use. According to Marschke (2005), drama establishes "meaningful communicative contexts" in which students can practice linguistic functions such as requesting, apologizing, persuading, or describing.

Furthermore, drama develops learners' sociolinguistic competence, the ability to choose appropriate language forms based on context, relationship, and intention. By adopting different roles and identities, students learn to vary their tone, register, and vocabulary. For example, negotiating in the role of a shopkeeper differs linguistically and pragmatically from speaking as a friend or teacher. Such exercises nurture pragmatic awareness and intercultural sensitivity, crucial skills in global English communication.

Drama also supports cognitive flexibility. Nilson (2021) notes that taking on diverse characters enables learners to see the world from multiple perspectives, challenging personal assumptions and developing empathy. From a psycholinguistic perspective, this fosters perspective-taking and theory of mind, both of which are associated with improved communicative competence and critical thinking.

The affective benefits of drama are equally significant. Traditional classroom environments can often inhibit students, especially those anxious about speaking in front of others. By contrast, drama lowers the affective filter (Krashen, 1982), reducing anxiety through playful interaction and collective performance. Learners become emotionally invested in their roles, which increases motivation and willingness to communicate. Moreover, as studies by Kao and O'Neill (1998) show, drama can transform classrooms into safe spaces for experimentation, where mistakes are reframed as opportunities for creative exploration.

Pedagogical Applications of Drama in ELT

Drama can be adapted to virtually any language skill or teaching context. It can be used to teach grammar implicitly through communicative tasks, to introduce vocabulary through storytelling, or to enhance pronunciation through rhythm, stress, and intonation practice.

1. Teaching Grammar and Vocabulary

Rather than relying on rote memorization, drama situates grammatical structures within authentic communicative situations. For example, a "crime scene investigation" activity may require students to use the past tense and question forms ("Where were you last night?" "Did you see anything unusual?"). Because the language is embedded in meaningful action, retention and transfer improve.

2. Developing Listening and Speaking Skills

Process drama emphasizes interaction and improvisation, compelling learners to listen actively and respond appropriately. These exchanges mimic natural conversation, improving fluency and confidence. As Wessels (1987) observed, students who participate in drama gain "a sense of real communication," learning to express themselves beyond textbook dialogues.

3. Enhancing Pronunciation and Prosody

Drama inherently focuses on how something is said, not just what is said. Through acting exercises, students practice stress, rhythm, and intonation, developing more natural and expressive speech patterns. Choral reading, recitation, and performance poetry are particularly effective for this purpose.

4. Teaching Culture and Intercultural Competence

Language learning is inseparable from culture. Through role-play, learners explore cultural norms, social rituals, and pragmatic differences, gaining insight into the values underlying communication. Performing culturally diverse roles encourages intercultural empathy and respect—essential qualities in multilingual societies.

Theoretical Underpinnings of Drama Pedagogy

Drama in language education is supported by a strong theoretical foundation that draws from several key traditions:

- Constructivism: Learners build knowledge through active participation and reflection. Drama situates learning in authentic social interactions that promote internalization of language.
- Sociocultural Theory (Vygotsky, 1978): Language develops through mediated social activity. Drama provides the "zone of proximal development" by scaffolding learners' interactions.
- Multiple Intelligences Theory (Gardner, 1983): Drama activates linguistic, bodily-kinesthetic, interpersonal, and intrapersonal intelligences simultaneously, catering to diverse learning styles.
- Embodied Cognition (Glenberg, 2010): Learning is grounded in sensory and motor experiences. Drama connects linguistic symbols with physical enactment, deepening semantic processing.

- Communicative Language Teaching: Drama reinforces the communicative approach by prioritizing meaning, interaction, and real-life discourse over mechanical form practice.

These frameworks collectively elucidate drama's potency as a multidimensional learning method that unites mind, body, and emotion.

Inclusion of Technology and AI in Drama Activities

The rapid expansion of digital tools has transformed how drama can be implemented in ELT classrooms. Augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) now offer immersive extensions to traditional dramatic methods.

AR, for example, overlays digital information on real-world spaces, turning a classroom into a multisensory stage. Learners can act out dialogues in simulated environments such as markets, airports, hospitals. This will enable them receive contextual vocabulary prompts or pronunciation feedback. Such multimodal interaction enhances memory and engagement (Huang, 2022).

AI integration represents a newer frontier. Ding (2024) introduces the concept of intermedial meaning making, where students co-create performances alongside AI tools. AI can function as a creative partner, generating character backstories, dialogue suggestions, or alternate scenarios. This not only enhances learners' prompt-generation skills but also strengthens their writing and editing abilities.

Bsharat and Ahmad (2025), studying Palestinian EFL teachers, found widespread optimism about AI-assisted drama, citing its potential to increase participation, authenticity, and creativity. However, they also identified challenges; chiefly, limited infrastructure, teacher readiness, and ethical concerns regarding AI's influence on creativity.

Prominent AI-supported systems such as CO-OPERA, which enables collaborative scriptwriting with generative AI input, and Theatrical Language Processing (TLP), which provides improvisation cues, exemplify how technology can augment human creativity. Yet, overuse of automation risks reducing learners' autonomy. The key lies in balance: using AI to support, not replace, the embodied and social nature of drama.

When thoughtfully integrated, technology can enhance accessibility, provide instant feedback, and simulate authentic communicative situations, extending the reach of drama beyond the physical classroom.

The Evolving Role of the Teacher

The integration of drama and technology transforms the teacher's role from that of a traditional instructor to a multifaceted facilitator who bridges pedagogy, performance, and technology.

In traditional drama-based teaching, the teacher functions as a director, organizing scenes, modeling language, and guiding reflection. Heathcote (1991) emphasized that teachers must "create situations to happen," meaning they set up frameworks that allow learners to discover solutions and express meaning through action.

In technologically enhanced contexts, however, the teacher also becomes a digital mediator. This role involves selecting appropriate tools, integrating AR or AI into dramatic tasks, and maintaining the focus on communicative and ethical learning. The teacher must monitor not only linguistic performance but also learners' emotional engagement and digital literacy.

Additionally, the teacher assumes an ethical responsibility to ensure that AI integration respects students' privacy, creativity, and autonomy. As technology increasingly mediates communication, maintaining the human dimension of language learning becomes a critical challenge.

Ultimately, whether traditional or tech-enhanced, the teacher's most vital role is to sustain a safe, creative, and reflective environment where learners feel empowered to take linguistic and emotional risks.

Discussion, Conclusion, and Suggestions

Discussion

The cumulative evidence suggests that drama serves as a uniquely powerful bridge between language learning and human development. Its influence extends beyond linguistic competence to include motivation, empathy, self-expression, and intercultural understanding. By engaging the body, voice, and mind, drama transforms language learning into a lived experience rather than a mechanical exercise.

Empirical studies consistently report gains in fluency, pronunciation, vocabulary retention, and confidence among learners who participate in drama-based instruction. Moreover, the social and affective dimensions, such as teamwork, empathy, and reduced anxiety, further reinforce learning outcomes. These findings align with the notion that language acquisition is not purely cognitive but also socially and emotionally mediated.

The integration of technology, especially AI, offers exciting new possibilities for personalization and creative expansion. The new generation of learners will easily deal with technologically designed materials. However, these advances also bring risks of over-mechanization, where learners might depend too heavily on automated outputs rather than developing spontaneous communicative competence. The key lies in the pedagogical intentionality of the teachers who use technology to extend human creativity rather than replace it.

Thus, the future of drama in ELT likely resides in blended pedagogy, where embodied, social learning is complemented, not supplanted by digital tools in a way that dominates teachers' classroom performance. Such an approach honors the spirit of drama while embracing innovation.

Conclusion

Drama serves as a reinforcing and transformative technique in English language teaching, integrating the linguistic, cognitive, affective, and social dimensions of learning. It offers a living context for language, where learners acquire not only words and structures but also empathy, creativity, and communicative confidence.

As this study has shown, drama's theoretical underpinnings from constructivism to embodied cognition explain its power to make learning both meaningful and memorable. Empirical research continues to confirm its broad effectiveness across skill areas and age groups.

The inclusion of technology and AI introduces new opportunities for immersion, adaptability, and innovation. Yet, these tools can only enhance learning if used ethically and thoughtfully, under the guidance of skilled teachers who maintain the human essence of drama, and teachers who care and strive to bring up rounded individuals.

Ultimately, drama endures as one of the most holistic and enduring pedagogical strategies in language education. Whether performed on a classroom stage or mediated through a digital screen, it continues to remind us that language is, above all, a social and creative act - a way of being, doing, and understanding the world together. Therefore, the exploitation of innovative approaches, techniques, and applications should be put into practice by considering the needs and expectations of the learners.

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The Magic of Children's Drawings: A Window into Their Cognitive and Emotional Worlds

Verka Brdarova[1]

Abstract

Children's drawings are far more than decorative expressions or playful activities; they serve as powerful cognitive and emotional artifacts that reveal how young learners interpret, organize, and interact with the world around them. Each line, symbol, and color choice represents an intentional act of meaning-making, shaped by the child's developmental stage, social environment, and cultural experiences. From a constructivist perspective, children's art exemplifies the foundational principle that knowledge is not passively absorbed but actively constructed through interaction, exploration, and reflection. Drawing becomes a form of thinking—an externalized process through which children test hypotheses, negotiate understanding, and create representations of both internal and external realities.

Beyond simple visual output, children's drawings function as semiotic tools that allow them to communicate thoughts that they may not yet have the linguistic capacity to articulate. Through the use of shapes, spatial arrangement, and symbolic representation, children develop their own visual language systems. These systems help them make sense of abstract concepts such as relationships, identity, belonging, and emotional states. In this way, drawings act as windows into children's cognitive processes, offering educators rich opportunities to observe patterns of perception, reasoning, and imagination.

Socio-emotionally, drawings provide a safe expressive outlet where children can externalize feelings that might otherwise remain unspoken. For many young learners—particularly in culturally diverse settings such as Qatar—art becomes a bridge between their inner experiences and the expectations or norms of their surroundings. The act of drawing supports emotional regulation, builds confidence, and fosters resilience. When educators validate children's artistic expressions, they reinforce a sense of autonomy and self-worth, essential components of intrinsic motivation and lifelong learning

Culturally, children's drawings hold deep significance, reflecting both shared developmental traits and localized cultural narratives. In Qatari and international contexts, visual patterns often reveal the influence of family structures, traditions, and community values. For instance, recurring motifs such as homes, mosques, animals, or flags highlight how children internalize and reproduce cultural identities through art. These visual narratives help researchers understand how cultural belonging is constructed from an early age and how global and local influences intersect in children's meaning-making processes.

This paper, through qualitative interpretation and semiotic analysis of drawings collected from diverse Qatari and international early childhood settings, underscores the multi-layered nature of children's visual expressions. Findings indicate that children's drawings serve as non-verbal indicators of developmental progression, emotional balance, and cultural grounding. They reveal universal

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milestones—such as the transition from scribbles to representational forms—while simultaneously highlighting individual differences influenced by experience, environment, and cultural context.

Ultimately, the study argues that children's drawings are indispensable tools for understanding holistic development. They offer educators an authentic means of assessing learning, identifying needs, and tailoring instruction. Recognizing the pedagogical importance of art not only enriches early childhood practice but also supports broader educational reform efforts aimed at fostering creativity, critical thinking, and culturally responsive learning environments.

Keywords: Constructivism, Children's Drawings, Cognitive Development, Emotional Expression, Early Education.



Introduction

Children's drawings extend beyond decoration; they act as semiotic media through which young learners externalize cognition, emotions, and conceptual understanding before linguistic mastery. They serve as symbolic representations that enable children to construct meaning, negotiate identity, and engage in early knowledge-building practices. This study situates children's drawings within a constructivist framework (Piaget, Vygotsky, Bruner), emphasizing their role as tools for communication and meaning-making.

You know how kids can turn a random drawing into a whole universe? Or how a single emoji can cause an entire family WhatsApp war? That's the magic of semiotic media—signs, symbols, and meanings that shape how we understand the world."

Now, let's add a serious layer: semiotics isn't just about signs. It's about how we humans constantly decode them. Roland Barthes would say: 'A croissant is never just a croissant.' (Especially in Paris—it's a lifestyle.)

So when we talk about semiotic media, we're really talking about how culture sneaks into every message we share."

Take children's drawings as an example. To adults, it might look like a purple potato with legs. But to the child, it's their dog, their friend, their superhero. Signs aren't just shapes—they're stories, identities, emotions.

Even that purple blob your child drew is a sign — in their mind, it might be a dinosaur saving the universe!

Suddenly, learning isn't just textbooks—it's decoding the world children are already creating.

Semiotic media is basically the universe whispering: 'Decode me.'

And as educators, researchers, or just curious humans, our job is to listen.

And why is that important? Because meaning isn't just transmitted — it's created, negotiated, and sometimes even misinterpreted.

Children's drawings provide a non-verbal mode of expression that reveals developmental stages often invisible in verbal assessments.

A drawing might look like simple lines, but to the child it could be a story of family, hope, or imagination. A symbol in media might look universal, but it changes meaning across cultures. What I'm trying to do is decode these signs — to show how they reflect learning, identity, and creativity.

What's unique here is that I'm blending theory with lived practice. Instead of treating drawings or signs as decoration, I treat them as data. They are cultural fingerprints — each one saying something about how we learn, how we connect, and how we see the world."

Children's drawings are not mere decoration—they are semiotic media through which young learners externalize cognition, emotion, and cultural identity, often before they have full linguistic mastery.

AI can highlight fine-motor development, detect recurring themes that signal a child's interests, compare progress over time, and even connect drawings to digital activities like interactive storytelling, art-based quizzes, or collaborative games.

Literature Review

Research across global contexts reveals that children's artwork highlights universal milestones such as symbolic play and narrative construction while also reflecting cultural markers including family structures, heritage, and community values. In Qatar, children's drawings often blend local traditions with global perspectives, demonstrating how cultural identity and creativity coexist in early learning.

Piaget (1952) conceptualized symbolic representation as a cornerstone of cognitive development, while Vygotsky (1978) situated learning within social interaction and cultural context. Bruner (1986) later described children's meaning-making as narrative construction—an active process of organizing

experience. Together, these perspectives form the theoretical foundation for interpreting children's drawings as acts of thinking and communication. Kress (2010) and Malchiodi (2012) expanded this understanding through semiotic analysis, viewing children's artwork as a multimodal text—where color, form, and composition encode meaning. In multicultural contexts, such drawings serve as visual negotiations of identity. In Qatar, they symbolize a balance between heritage and modernity. Emerging technologies now allow educators to study drawings through AI-assisted tools, providing insights into fine-motor development, thematic trends, and emotional states (Brdarova, 2025). This methodological evolution connects constructivism with 21st-century educational innovation.

Children's drawings therefore function not only as spontaneous artistic acts but as layered developmental narratives. In early childhood classrooms, drawings often reveal shifts from sensory exploration to structured symbolism, tracing transitions from scribbling stages to representational depiction. Researchers have documented that children move from uncontrolled marks toward intentional forms—circles becoming faces, lines evolving into family members, houses, and stories of daily life (Lowenfeld & Brittain, 1987). Across cultures, the representation of the family is one of the earliest recurring themes, reflecting emotional bonds and social priorities. In Qatar, drawings frequently depict extended family gatherings, mosques, falcons, and national flags, illustrating how personal identity is embedded within cultural belonging and national pride.

Drawings also illustrate emerging emotional literacy. Colors, facial expressions, and spacing on paper can signal confidence, anxiety, or joy. As Denham (2007) suggests, emotional meaning is communicated through visual choices long before children develop sophisticated verbal capacity. When a child draws a large parent figure towering protectively above a smaller child, it may represent security or admiration; conversely, absence of family members or use of dark aggressive strokes may indicate emotional tension or fear. Such interpretations require sensitive contextual reading, yet they demonstrate the potential of drawings as diagnostic windows into children's wellbeing.

Within the constructivist paradigm, drawings emerge through interaction—between child and environment, memory and imagination, culture and self. Vygotsky (1978) emphasizes the Zone of Proximal Development, suggesting that children grow cognitively through guided interaction. When teachers engage with drawings through open-ended questioning—"Who is this?" "What is happening here?"—they scaffold reflection, narrative building, and linguistic expansion. Thus, art becomes dialogic, a collaborative exchange rather than a product. This dialogic process affirms the child's voice and positions them as meaning-makers in control of their narrative.

In Qatar, where diverse international communities intersect, children's drawings carry hybrid cultural scripts. A single artwork may depict a child wearing traditional thobe alongside global media characters, symbolizing a coexistence of heritage and modernity. These hybrid representations underscore how globalization reshapes identity formation and how young learners internalize cultural interplay. Drawings thus serve as cultural texts, encoding belonging, diversity, and multilayered identities.

Technology adds a new dimension to this field. AI-assisted drawing analysis tools can track developmental progression, detect recurring symbols, and compare outputs across time. Brdarova (2025) argues that digital interpretation may deepen assessment practices, especially in large-scale early childhood settings where educators require efficient observational tools. AI cannot replace human interpretation, but it can support teachers in identifying patterns, prompting interventions, or designing art-based learning tasks tailored to a child's developmental needs. This convergence of constructivism and technology signals a shift toward more evidence-based art pedagogy.

Globally, interest in drawing research aligns with broader educational goals emphasizing creativity, critical thinking, and holistic development. UNESCO and multiple international frameworks advocate arts integration as key to 21st-century competencies. Children's drawings are thus not peripheral activities but essential cognitive and emotional instruments. They support problem-solving, visual literacy, and narrative competence while fostering intrinsic motivation. They also enable culturally responsive pedagogy, especially in multilingual classrooms where drawing functions as an equitable communication bridge.

In conclusion, children's drawings operate simultaneously as developmental mirrors and cultural maps. They bridge cognition, emotion, and identity, offering educators rich insight into how children perceive themselves and the world. The literature reinforces that drawings can guide assessment, shape inclusive pedagogy, and inform curriculum design. As Qatar advances toward the goals of the Qatar National Vision 2030, integrating art-based inquiry in early learning presents an innovative pathway to nurture creativity, identity, and global citizenship. Future research may expand cross-cultural comparative studies, explore AI-enhanced assessment, and investigate how children's visual languages evolve in multilingual, technology-rich environments. Ultimately, children's art invites educators to listen, observe, and honor the stories young learners tell long before words fully arrive.

Method

Framework: Constructivist theory. Piaget, Vygotsky, Bruner. Drawings are interpreted as **narratives in visual form**, shaped by imagination and lived experience.

Constructivist interpretations guide this analysis, emphasizing drawing as a process of constructing meaning through interaction. Semiotic and phenomenological approaches inform how visual choices—color, composition, and spatial organization—reflect thought and feeling.

Findings highlight three domains:

- **Cognitive** → spatial awareness, abstraction, problem-solving.
- **Socio-emotional** → resilience, coping, and self-esteem.
- **Cultural** → integration of family, heritage, and global motifs.

Contexts: individual drawings (inner states), classroom drawings (collective identity).

Approach: Qualitative interpretation of children's drawings.

Semiotic analysis considered visual choices—color, composition, and symbolism—as expressions of cognition and emotion.

Contexts included individual, collaborative, and cross-cultural settings.

Contextual Triangulation and Ecological Validity

To maintain methodological robustness, drawings are interpreted within their natural contexts.

- **Individual contexts** emphasize introspection, personal narratives, and self-representation.
- **Classroom or collaborative contexts** highlight shared symbols, collective identity, and peer-mediated meaning-making.
- **Cross-cultural contexts** reveal how cultural scripts, community norms, and global influences shape artistic expression.

This triangulation ensures **ecological validity** in interpreting visual data

A semiotic perspective guides the decoding of symbolic content embedded in children's artworks.

- Visual elements (color palette, line quality, composition, spatial organization, and iconographic motifs) are analyzed as **semiotic resources**.
- These elements function as **signifiers** that reveal underlying cognitive structures, emotional narratives, and cultural references.
- The drawing is treated as a **multimodal sign system**, not a decorative illustration.



Findings

Findings reveal interconnected domains of cognition, emotions, and cultural identity in children's drawings. The analysis demonstrated that artistic expression functions as a holistic developmental medium.

Children in open-ended, constructivist classrooms produced more diverse, narrative-rich drawings than those in restrictive environments. Drawings from Qatari nurseries highlighted family ties, national identity motifs, and cultural pride, aligning with Qatar National Vision 2030 goals for creativity and human development.

The results matter at three levels:

- Theoretical → A framework connecting cognition, emotion, and culture through art.
- Practical → Non-invasive assessment tools for teachers, with AI support to spark storytelling, track growth, and personalize learning.
- Policy → Alignment with Qatar National Vision 2030 and global frameworks (UNESCO, EYFS, Finnish curriculum), emphasizing creativity, cultural identity, and innovation."

Children's drawings illustrate that learning emerges through doing, observing, and imagining.

Cognitive dimensions include enhanced spatial reasoning, abstraction, and problem-solving through symbolic representation.

Socio-emotional development emerges through drawings expressing stress, resilience, empathy, and confidence—demonstrating that visual creativity supports emotional literacy.

Cultural identity is evident as art integrates national motifs and personal values, bridging family, heritage, and global imagery. Inclusion of cultural belongings: flags, family gatherings, national identity motifs. Qatar-specific: family ties, and national identity motifs alongside global icons like superheroes or popular media characters.

Educational insights: Children in open-ended, constructivist classrooms produce more diverse, narrative-rich drawings.

Restrictive environments → repetitive, less imaginative representations.

Individual drawings reveal children's internal narratives and imaginative reasoning. Collaborative drawings reflect negotiation, collective imagination, and peer learning.

Qatar nurseries emphasize cultural values and familial connections, while international nurseries highlight global diversity and hybrid cultural motifs. Ethical compliance followed early childhood research standards in Qatar.

Globally, comparisons show variation: Scandinavian drawings often stress nature, while Qatari/Arab contexts highlight family and community values, Asian contexts highlight community and harmony.

Individual drawings reveal children's internal narratives and imaginative reasoning. Collaborative drawings reflect negotiation, collective imagination, and peer learning.

Qatar nurseries emphasize cultural values and familial connections, while international nurseries highlight global diversity and hybrid cultural motifs. Ethical compliance followed early childhood research standards in Qatar.

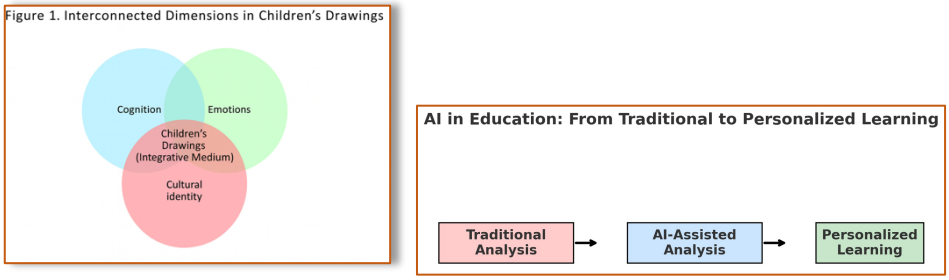


Figure 1. Children's Drawings Reflect Interconnected Domains of Cognition, Emotion, and Cultural Identity.

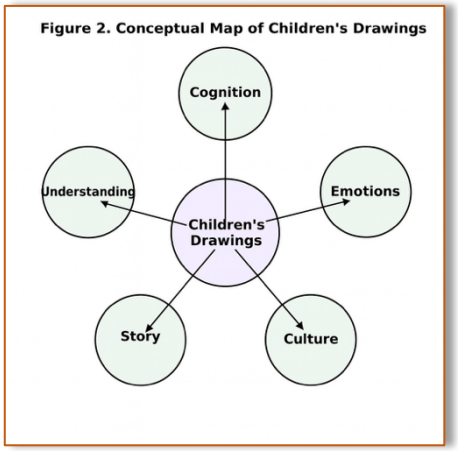


Figure 2. Interpretive Pathway of Children's Drawings — from Creation to Narrative Meaning.

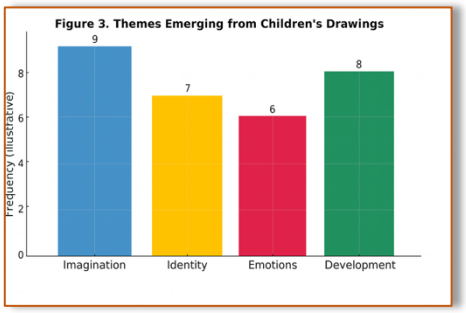


Figure 3. Emerging Themes — Imagination, Emotions, Family, Identity, and Growth.

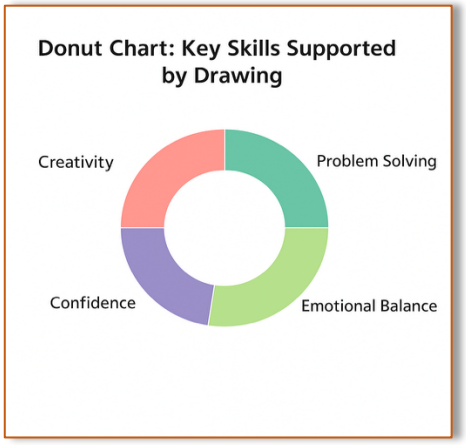


Figure 4. Key Skills Supported by Drawing — Creativity, Confidence, and Problem-solving.

Discussion, Conclusion, and Suggestions

Children's drawings illustrate how imagination, cultural belonging, and emotional well-being intertwine within constructivist early education. These findings advocate embedding art-based inquiry into curricula and teacher training as essential for holistic development. Future studies should expand cross-cultural comparisons to explore how artistic expression supports global citizenship and lifelong learning. This research validates children's drawings as pedagogical and diagnostic tools. They transform art from play into purposeful learning aligned with developmental goals. Key benefits include cognitive growth (creativity, abstraction), socio-emotional skills (empathy, resilience), and cultural identity (belonging and intercultural awareness). In Qatar, this approach supports Qatar National Vision (QNV) 2030 goals for human development and creativity. Internationally, it offers a culturally adaptable framework for early learning assessment and teacher training.

Children's drawings are living narratives that integrate thought, feeling, and identity. A constructivist interpretation reveals how children construct knowledge visually and socially, underscoring art's vital role in holistic education. Educators should embed drawing within observation and assessment frameworks, interpreting visual narratives as evidence of learning. Policy implication: educational institutions should integrate art-based assessment into national frameworks. Future studies may employ longitudinal and AI-based analyses to deepen understanding of developmental and cultural patterns.

Extending this perspective further, children's artwork can be viewed as a mirror of evolving cognitive processes and emotional states, capturing subtle developmental changes that may not surface through traditional testing. Drawings reflect children's problem solving, symbolic reasoning, and conceptual growth, offering a non-invasive and child-friendly assessment method. When educators engage with children's art dialogically—asking guiding questions, encouraging narration, and linking drawings to lived experiences—learning becomes more reflective, collaborative, and learner-centered. This approach aligns with modern educational reforms that emphasize creativity, experiential learning, and child agency.

Moreover, children's drawings strengthen socio-emotional development by enabling expression of joy, fear, curiosity, and social relationships. Through visual storytelling, children process their environments, articulate internal experiences, and build confidence in communicating ideas. In culturally diverse settings such as Qatar, drawings often serve as bridges connecting heritage with modern influences. Patterns, symbols, and color choices reveal relationships with family, community, and national identity, illustrating how belonging is cultivated from early childhood onward.

From a policy standpoint, integrating structured drawing sessions into early years curricula may enrich observational assessment and support individualized learning plans. Teacher training programs could include modules on visual analysis, semiotic interpretation, and culturally responsive approaches to children's art. AI tools can further support educators by identifying reoccurring symbols and tracking

developmental progress over time, enhancing research accuracy and opening new pathways for large-scale comparative studies.

Ultimately, children's drawings deserve recognition not merely as artistic output, but as meaningful data that reflect growth, communication, and identity construction. Valuing these visual narratives strengthens early education, aligns with global visions for sustainable human development, and nurtures generations of creative, empathetic, and culturally grounded learners prepared to thrive within an interconnected world.

Acknowledgment

Data available upon request.

All content integrity remains under author responsibility.

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An Analysis Of Four-Hand Piano Studies In Turkey From Various Criteria

Dr. Öğr. Üyesi Özlem Tuzcu[1]

Abstract

A review of the literature reveals that four-hand piano studies occupy an important role not only in beginner piano education but also in the ongoing piano education process. Moreover, research findings indicate that four-hand piano practice, often referred to as a "duet" in the literature, makes playing and practicing the instrument more motivating compared to solo practice. Four-hand piano studies help students develop fundamental elements of making music together—such as rhythmic unity, polyphonic perception, and synchronization—while simultaneously improving pedal technique, the use of gestures and facial expressions, and breath control. In addition, four-hand piano playing has been shown to positively influence other factors including concentration, motivation and the development of empathy. In terms of its impact on performance anxiety and the opportunities it provides for peer learning, four-hand piano playing also plays a significant role in piano pedagogy. For this reason, it is important to examine studies conducted in the field of four-hand piano is important to present the existing literature and to determine trends in the field. In the relevant literature, pieces composed for piano four-hands and performed by two pianists are referred to as "duets," the performers are identified as a "duo." The French word 'ensemble' means "group," and the term "piano ensemble" refers to a group of pianists. This study aims to evaluate postgraduate studies published between 2006 and 2025 (July) in Turkey in the field of four-hand piano play, including the terms four-hand, duet, duo, and ensemble. The evaluation is carried out based on the criteria of year, data collection tools, research methods, topics covered, and results achieved. Furthermore, theses were analyzed with respect to their departments/programs, universities, and institutes in order to present a more comprehensive overview of the institutional distribution and contextual characteristics of the field. In line with the stated objective, the research aims to identify the aforementioned postgraduate studies based on the relevant criteria. The research was conducted using a survey research design and bibliography-based approach, utilizing Google Scholar and YÖK databases. Conference papers, articles and theses obtained as a result of searches conducted by entering the words "four-hand piano," "duet," "duo," "piano ensemble," and "chamber music" into the databases were included in the study if they were found to be relevant to the subject. The study evaluated the current situation by identifying the areas where the relevant criteria were most significant, discussed the findings, and made various recommendations for the field.

Keywords: four-hand piano, duet, duo, piano ensemble, chamber music

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Introduction

Problem Statement

Piano education, one of the fundamental components of music education, is a multifaceted process that supports both the technical and musical development of the individual. Thanks to its polyphonic structure and extensive repertoire, the piano is used as an important tool in music education programs for developing both individual and ensemble music-making skills. In this context, four-hand piano works performed by two pianists on the same instrument have a distinct educational value in terms of developing students' skills in coordination, listening, musical expression, collaboration, and rhythmic integrity.

Historically, four-hand playing became widespread in European music culture from the 18th century onwards, becoming an important part of both home music practice and professional education. The proliferation of this genre, both in terms of repertoire and pedagogical function, is directly related to the increasing social and educational role of the piano. Today, four-hand works contribute not only to the development of technical skills but also to the acquisition of emotional and social skills such as musical interaction, communication, empathy, and cooperation.

In piano teaching, four-hand works develop not only the student's individual performance skills but also their responsibility for making music together and their culture of musical sharing. In this respect, four-hand pieces are also important in terms of instilling an “ensemble” awareness in music education programs. Gaining experience in playing together supports the development of skills such as tempo tracking, mutual listening, a holistic approach to the piece, and musical expression (Atalay, 2019; Erdoğan and Tuncer Boon, 2023).

Research in the literature (Ağayeva, 2017; Karaniş and Albuz, 2023; Elik, 2021) shows that four-hand works increase students' musical awareness, support their motivation, and reduce performance anxiety. However, it is observed that the number of academic studies on four-hand piano teaching in Turkey is limited and that research in this field is concentrated mainly in certain universities. This situation suggests that four-hand piano teaching is not addressed systematically enough at both the curriculum level and in the practical teaching process.

At this point, a comprehensive examination of postgraduate studies on four-hand piano is important in terms of revealing the general trends and research gaps in the field. Such an examination will contribute to determining the trends in academic studies conducted in the field of music education, evaluating the place of four-hand studies in teaching processes with concrete data, and guiding future research.

The main problem of this research is shaped around the question, “What are the general trends in graduate studies on four-hand piano in Turkey?” In line with this main problem, the distribution of studies prepared in the field of four-hand piano in Turkey between 2006 and 2025 (July), including the terms four-hand, duet, duo, and ensemble, was examined according to years, research methods, data collection tools, topics covered, and results obtained. Additionally, the study attempted to reveal the results in terms of the criteria of the main field of study/main art discipline, university, and institute in the theses included in the research.

Research Objective

This study examines works (papers, articles, theses) in the field of four-hand piano published in Turkey between 2006 and 2025 (July). In this context, answers were sought to the following questions:

1) How are works on four-hand piano distributed according to the years they were published?

2) How are studies on four-hand piano distributed according to the data collection tools they used?

3) How are studies on four-hand piano distributed according to the research methods they used?

4) What is the distribution of four-hand piano studies according to the topics they address?

5) What is the distribution of four-hand piano studies according to the results they achieve?

6) What is the distribution of four-hand piano theses according to their main science/art disciplines?

7) What is the distribution of theses on four-hand piano according to the universities where they were published?

8) What is the distribution of theses on four-hand piano according to the institutes where they were published?

Importance of the Research

This research, which examines postgraduate studies in the field of four-hand piano, is important in that it reveals the general overview of studies conducted according to criteria such as year, department/field of study, university, institute, data collection tools, research methods, topics covered, and results achieved. Furthermore, the study is considered important in terms of revealing the process that studies in the field of four-hand piano have undergone from the past to the present.

Limitations of the Study

This research is limited to papers, articles, and theses published in Turkey that are registered in Google Scholar and the Higher Education Council (YÖK) National Thesis Center and whose titles include the words "four-hand piano," "duet," "duo," "piano ensemble," or "chamber music."

Method

Research Model

In this study, the descriptive survey model was used from among survey models. In this model, the aim is to collect objective data in its natural environment without intervening in events and phenomena (Karasar, 2012).

Population Sample

Four master's, doctoral, and artistic proficiency theses completed in Turkey and registered with the Higher Education Council (YÖK) National Thesis Center; seven articles and one paper registered in the Google Scholar database constitute the population of this research. At this point, the study population consists of 4 master's, doctoral, and artistic proficiency theses completed in the fields of master's, doctoral, and artistic proficiency registered with YÖK, 7 articles, and 1 paper prepared between 2006 and 2025 (July). The entire study population was reached in the research. Therefore, no sample selection was made.

Table 1.

Distribution Table Of Graduate Studies On Four-Hand Piano By Type

Type	f	%	Description
Thesis (Master's, Doctorate, Master of Arts)	4	33,3	Postgraduate theses registered in the YÖK National Thesis Center.
Article	7	58,3	Scientific articles registered in the Google Scholar database.
Paper	1	8,3	Papers presented at academic conferences registered in the Google Scholar database.
Total	**12**	**100,0**	The entire population was reached in the study; no sampling was performed.

Data Collection Tools

This study utilized the Google Scholar database, the Higher Education Council (YÖK) National Thesis Center database, and the "Document Review Form" developed and organized by the researcher. The Document Review Form includes criteria such as the year the thesis was completed, the field of study, the university, the institute, data collection tools, research methods, topics covered, and results achieved.

Data Collection

Limited to the Google Scholar database and the Council of Higher Education (YÖK) National Thesis Center, this study included postgraduate studies published between 2006 and 2025 (July) with the words

"four hands," "duet," "duo," and "ensemble" in their titles. The search yielded a total of 12 postgraduate studies, including 1 conference paper, 7 articles, and 4 completed master's, doctoral, and artistic proficiency studies.

Data Analysis

Jamovi and Microsoft Excel software were used to analyze the data obtained from the theses examined in this study. These data, evaluated using frequency (f) and percentage (%) distributions in descriptive statistical methods, were presented in tables and graphs as findings and interpreted.

Ethical Permissions for the Research

This research examined papers, articles, and theses accessible in the Google Scholar database and those with access permission in the Higher Education Council (YÖK) National Thesis Center. Therefore, ethical committee approval was not deemed necessary.

Findings and Interpretation

This section presents findings related to master's, doctoral, and postgraduate theses in the field of piano performance registered at the National Thesis Documentation Center of the Higher Education Council in Turkey between 2006 and 2025 (July), as well as articles and papers found in the Google Scholar database. The findings are presented in accordance with the order determined in line with the objectives of the research.

Findings on the Distribution of Graduate Studies on Four-Hand Piano by Publication Year

Table 2.

Distribution Table Of Postgraduate Studies On Four-Hand Piano By Year Of Publication

Yıl	Tür	f	%
2006	Article	1	8,33
2017	Article	1	8,33
2018	Article	2	16,67
2019	Thesis	1	8,33
2020	Article	1	8,33
2021	Thesis	1	8,33
2023	Article, Paper, Thesis	5	41,67
Total		**12**	**100,00**

As shown in Table 2, the highest percentage in the distribution of postgraduate theses on the subject of guitar by year is 41.67% for 2023. In 2023, 2 articles, 2 theses, and 1 paper were published. This is followed by 2018 with 16.67%, and 2017, 2019, 2020, and 2021 with 8.33%. This situation reveals that academic interest in the field of piano for four hands has increased, especially in recent years.

Findings Regarding the Distribution of Data Collection Tools Used in Graduate Studies on Four-Hand Piano

Table 3.

Distribution Table According to Data Collection Tools Used in Graduate Studies on Four-Hand Piano

Study #	Literature Review	Interview Form	Content Analysis	Survey	Observation
#1	✓	✓		✓	✓
#2	✓		✓		
#3		✓	✓		
#4	✓	✓	✓	✓	
#5	✓				
#6	✓				
#7	✓				

#8		✓			
#9	✓		✓		
#10	✓				
#11	✓	✓	✓		
#12				✓	
Total (%)	9 (%75)	5 (%42)	5 (%42)	3 (%25)	1 (%8)

Although there are a total of 12 studies, multiple types of data collection tools were used in some of the studies. This is why the frequency value in this table exceeds the number of studies available.

As seen in Table 3, the most frequently used data collection tool in the four graduate studies on piano is literature review (75%). This is followed by interview forms and content analysis at 42%, and survey methods at 25%. Observation forms were used in 8% of the studies. This finding indicates that document review and qualitative data collection techniques are preferred in research.

Findings Regarding the Distribution of Research Methods Used in Graduate Studies on Four-Hand Piano

Table 4.

Distribution Table Of Research Methods Used in Graduate Studies on Four-Hand Piano

Research Method	**f**	**%**
Quantitative Research	0	0
Qualitative Research	11	91,67
Mixed Methods	1	8,33
Total	**12**	**100,00**

Table 4 shows that qualitative research methods were predominantly preferred (91.67%) in postgraduate studies on four-hand piano. The proportion of studies using mixed methods is 8.33%, while quantitative research methods are not encountered. This finding indicates that research in the field of four-hand piano predominantly adopts a qualitative approach based on in-depth investigations.

Findings Regarding the Distribution of Topics Covered in Graduate Studies on Four-Hand Piano
Table 5.

Distribution Table Of Topics Covered İn Graduate Studies On Four-Hand Piano

Study #	**Historical Development**	**Student Performance**	**Work Analysis**	**Work Collection**	**Bibliography**
#1		✓			
#2			✓		
#3		✓			
#4				✓	
#5	✓				
#6		✓			
#7	✓	✓			
#8		✓			
#9	✓		✓		
#10					✓
#11		✓			
#12		✓			
Total (percentage)	**3 (%25)**	**7 (%58)**	**2 (%17)**	**1 (%8)**	**1 (%8)**

* Although there are a total of 12 studies, some of them address more than one topic. This is why the frequency value in this table exceeds the number of studies available.

Table 5 shows that graduate studies on four-hand piano focus most heavily on the theme of "effects on student performance" (58%). This topic is followed by "historical development of four-hand piano" (25%) and "analysis of four-hand piano works" (17%). The topics "bibliographic approach to research" and "repertoire of four-hand works" account for 4% of the studies. The findings indicate that performance and educational gains are predominantly emphasized in the research.

Findings Regarding the Distribution of Postgraduate Studies on Four-Hand Piano Based on the Results Obtained

Table 6.

Distribution Table Of Postgraduate Studies On Four-Hand Piano Based On The Results Obtained

Study #	Composer and works	Skills acquired by the student	Four-Handed Work Analysis	Adaptation from works	Literature Analysis
#1		✓			
#2			✓		
#3		✓			
#4				✓	
#5	✓				
#6		✓			
#7	✓	✓			
#8		✓			
#9		✓	✓		
#10					✓
#11		✓			
#12		✓			
Total (percentage)	**2 (%17)**	**8 (%67)**	**2 (%17)**	**1 (%8)**	**1 (%8)**

*Although there are a total of 12 studies, some of them have yielded more than one result. This is why the frequency value in this table exceeds the number of studies available.

When Table 6 is examined, it is seen that the majority (67%) of the graduate studies on four-hand piano focus on musical and technical skills such as synchronization, coordination, motivation, polyphonic perception, musicality, sight-reading, rhythm perception, pedal use, awareness, empathy, attitude, and overcoming performance anxiety. This finding shows that performance development and educational gains are at the forefront of the research. This is followed by results presenting four-hand piano literature in terms of composers and works (17%), and work analyses encountered at the same rate (four-hand work analysis by C. R. Rey, Özkan Manav, and K. Czerny). Finally, studies that adapted works from the Baroque, Classical, Romantic, and Contemporary periods for four hands, thereby contributing to the literature, and studies that examined the literature on four-hand piano, evaluating their purpose, content, and results, accounted for 8% of the studies. This finding shows that performance development and educational gains are at the forefront of research. Furthermore, the 8% of studies involving analysis and adaptations added to the literature reveal that the field of four-hand piano has also diversified academically.

Findings Regarding the Distribution of Graduate Theses on Four-Hand Piano by Major Field of Study / Major Art Discipline

Table 7.

Distribution Table Of Graduate Theses On Four-Hand Piano By Major Field Of Study / Major Art Discipline

Department / Major	**f**	**%**
Department of Music Education	3	75,0

Major in Music	1	25,0
Total	**4**	**100,0**

Table 7 shows that the vast majority (75%) of graduate theses on four-hand piano were completed in the Music Education Department. In the Department of Music, there is only one thesis, which constitutes 25% of the total studies. This finding shows that four-hand piano studies are concentrated in the field of music education, thus indicating a focus on the teaching process.

Findings Regarding the Distribution of Master's Theses on Four-Hand Piano by University

Table 8.

Distribution Table Of Master's Theses On Four-Hand Piano By University

University	**f**	**%**
Gazi University	2	50,00
Dokuz Eylül University	1	25,00
Ordu University	1	25,00
Total	**4**	**100,00**

As shown in Table 8, half (50%) of the graduate theses on four-hand piano were completed at Gazi University. Dokuz Eylül University and Ordu University each have two studies, accounting for 25%. This indicates that Gazi University is the leading institution in graduate research on four-hand piano.

Findings Regarding the Distribution of Master's Theses on Four-Hand Piano by Institute

Table 9.

Distribution Table Of Master's Theses on Four-Hand Piano by Institute

Institute	**f**	**%**
Institute of Educational Sciences	3	75,00
Institute of Social Sciences	1	25,00
Total	**4**	**100,00**

Table 8 shows that the vast majority (75%) of master's theses on four-hand piano were completed within the Institute of Educational Sciences. Only one study (25%) in this field was conducted at the Institute of Social Sciences. This finding indicates that research is concentrated in education-focused graduate programs, with the pedagogical aspect of the research being at the forefront.

Discussion, Conclusion and Suggestions

This research was conducted to determine the current state of graduate studies on four-hand piano in Turkey, to reveal the directions of these studies, and to evaluate general trends in the field. The findings show that there has been a significant increase in academic interest in the field of four-hand piano, particularly in recent years. The studies were most intensive in 2023, and during this period, there was an increase in the production of theses, articles, and papers.

The fact that a large portion of the theses were conducted within the Department of Music Education, under the umbrella of the Institute of Educational Sciences, indicates that the topic of four-hand piano is approached in a more pedagogical and teaching-oriented manner. This can be attributed to the fact that four-hand piano provides both cognitive and affective gains in music education.

The most preferred method in research is qualitative research. The qualitative focus of the studies can be seen as an effort to provide an in-depth look at the multidimensional structure of four-hand piano performance, particularly its aspects of musical interaction, emotional sharing, communication, and collaboration. The prominence of literature review among data collection tools indicates that the historical, theoretical, and practical aspects of the subject are addressed together.

An examination of the research topics reveals that four-hand piano studies are most frequently grouped under the heading of “effects on student performance.” This indicates an increased awareness of the effects of four-hand playing on motivation, rhythm, musicality, technical development, and empathy skills in the educational process. The results of the studies also support this finding: four-hand

performance contributes to the development of students' technical skills as well as their musical sensitivity, synchronization, rhythmic integrity, and awareness of playing music together.

The findings show that studies in the field of four-hand piano in Turkey play an important role in the development of music education. Research focusing on this area, especially in recent years, parallels trends in the international literature. Four-hand performance is a teaching tool that supports not only technical development but also the development of affective skills such as cooperation, synchrony, listening, and empathy.

The fact that the studies were largely conducted using qualitative methods indicates that investigations in this field are more focused on depth of meaning and process analysis. However, due to the scarcity of studies conducted using quantitative or mixed methods, this also means that the quantitatively measurable outcomes of four-hand teaching (e.g., achievement scores, performance anxiety, cognitive gain level) have not been sufficiently demonstrated.

The findings show that four-hand studies reduce performance anxiety among teacher candidates, increase their self-confidence, and strengthen their sense of cooperation. This finding is consistent with studies such as Erdoğan (2023) and Göklen (2023). Furthermore, the results indicating that four-hand performance increases motivation in early piano education are consistent with “social interaction-based learning” theories in the field of educational psychology.

However, the fact that most of the studies examined are concentrated in specific universities suggests that regional diversity in the field is limited. Therefore, expanding four-hand piano research to include different institutions and samples will contribute to the enrichment of the field.

Based on the results obtained from this research, the following recommendations have been developed:

Recommendations for Researchers:

- The increased use of mixed and quantitative methods in new research in the field of four-hand piano will ensure that data related to the field is statistically supported.

- Comparative studies should be conducted on different age groups (e.g., children, adolescents, adults) and different educational levels (conservatory, music teaching, fine arts high school, etc.).

- Interdisciplinary research examining the effects of four-hand performance on emotional intelligence, communication skills, and social interaction should be included.

Recommendations for Educators:

- Four-hand pieces should be given more space in piano teaching to support the development of students' technical proficiency as well as their collaboration, musical awareness, and listening skills.

- Four-hand performance can be used as a motivational tool and a means of boosting self-confidence, especially for beginner students.

- Academic networks and workshops should be established where teaching staff can share information and materials on four-hand repertoire.

Recommendations for Institutions and Practice;

- Four-hand piano lessons should be integrated into university programs as a complementary component of individual piano education.

- Course materials and method books containing pedagogical sequences of four-hand works from different periods and composers should be prepared.

- It is recommended that students be encouraged to share their performances through “Four-Hand Piano Days” or “Ensemble Festivals” organized at the national level.

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15-17 OCTOBER 16th INTERNATIONAL BALKAN EDUCATION AND SCIENCE CONGRESS EDİRNE

The Role of Artificial Intelligence in Supporting Personalized Learning in Macedonian Language Instruction

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Abstract

Artificial intelligence (AI) is increasingly being integrated into higher education to support personalized and adaptive learning experiences. In this context, AI-based tools offer the potential to enhance student engagement, autonomy, and self-paced learning through interactive feedback and individualized instruction. This study examines the impact of an AI-powered chatbot (using the SchoolAI platform) on student achievement and learning engagement in university-level instruction of Macedonian Language and Culture of Expression 2. The participants were second-year students enrolled in a primary education program, representing future teachers who are simultaneously developing linguistic and digital pedagogical competencies.

The study initially involved 32 students who were granted access to the chatbot, but only 11 of them used it at any point during the semester. Among these users, interaction levels varied considerably. Most students engaged only sporadically or for specific tasks, while only three participants used the chatbot consistently and in greater depth. Some of these users expressed mild concerns about privacy, particularly the possibility that the instructor, as system administrator, could view their interactions. Students who did not use the chatbot provided no particular explanation for their non-participation. This uneven pattern of adoption suggests that the limited use may not be a technical issue but rather reflects pedagogical and psychological factors, such as trust, readiness for AI-based learning, and the perceived boundaries of supervision in educational technology. A comparative design was employed, contrasting results between the 11 active chatbot users (experimental group) and 13 students from the previous academic year who completed the same course with the same instructor but without access to AI tools (control group). Data collection included exam results, written and oral assignments, and informal feedback regarding user experience. Quantitative analysis (Welch's t-test and Cohen's d) was combined with qualitative interpretation of student reflections. Although no statistically significant difference was found ($p=0.17$), the effect size ($d=0.60$) indicated a moderate positive influence of chatbot use on learning outcomes.

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The findings emphasize that effective AI integration requires not only technical implementation but also pedagogical adaptation, fostering digital trust, transparent use policies, and sustained engagement. This study contributes to understanding both the potential and limitations of AI-supported personalized learning in language education.

Keywords: Artificial intelligence, personalized learning, chatbot, Macedonian language, higher education.

Introduction

The rapid advancement of artificial intelligence (AI) has profoundly influenced modern education, offering new possibilities for personalization, automation, and data-driven decision-making. In higher education, AI systems are increasingly used to analyze learning patterns, provide adaptive feedback, and support individualized instruction. These technologies enable teachers to respond to diverse student needs, while learners gain tools that promote self-regulation and autonomy. According to recent studies, the integration of AI in education enhances engagement and motivation when aligned with clear pedagogical goals and ethical considerations (Holmes et al., 2019; Luckin et al., 2022). However, the effective use of AI still depends heavily on contextual, linguistic, and cultural factors, especially in smaller language communities. Language and humanities education present unique challenges for AI application. While AI-powered tools have shown promise in grammar correction, text generation, and personalized tutoring in widely spoken languages, their performance in less-resourced languages often remains inconsistent. Macedonian, as a South Slavic language with a rich morphological system and syntactic flexibility, requires specialized linguistic adaptation to ensure the accuracy and relevance of AI feedback. As a result, integrating AI tools into Macedonian language instruction is not only a technical task but also a pedagogical experiment in understanding how students interact with automated linguistic feedback and how such interaction affects learning outcomes.

Despite global attention to AI in education, there is still limited empirical research on its pedagogical implications in the Western Balkans, particularly in the domain of teacher education. Future educators must be prepared to understand and critically use digital technologies that may transform their future classrooms. This is particularly important for students enrolled in teacher training programs, who are expected to develop both linguistic and digital competencies. The inclusion of AI-based tools in their own learning process provides a unique opportunity to evaluate how such technologies can contribute to self-directed learning, reflection, and critical thinking.

This study focuses on the application of an AI-powered chatbot, *SchoolAI*, designed to support students enrolled in *Macedonian Language and Culture of Expression 2* at St. Kliment Ohridski Faculty of Pedagogy - Skopje. The chatbot was used as a supplementary learning assistant providing explanations, writing feedback, and grammar exercises aligned with course objectives. The research aims to explore whether interaction with the chatbot can enhance students' academic performance, promote more autonomous learning behavior, and foster greater engagement in language study. To examine these aspects, a comparative design was implemented involving two student cohorts: one that used the chatbot during the semester and another from the previous academic year that followed the same curriculum without AI assistance. While the chatbot was made available to all students, initial classroom observations suggested differing levels of adoption and interaction, which motivated further investigation into the pedagogical and psychological factors influencing student engagement with AI-based learning tools. By addressing both the quantitative and qualitative aspects of this study, the research contributes to a better understanding of how AI-based tools can be effectively integrated into the teaching of Macedonian and similar less-resourced languages. It aims to provide practical and theoretical insights into the conditions under which AI can support personalized learning, as well as the challenges that arise from its linguistic and pedagogical limitations. Ultimately, this study positions AI not merely as a technological innovation but as a pedagogical instrument whose impact depends on thoughtful design, contextual adaptation, and the readiness of both students and teachers to embrace new forms of learning interaction.

Literature Review

Artificial intelligence has become a transformative force in education, reshaping the ways teaching, learning, and assessment are designed and delivered. The increasing integration of AI-driven tools in higher education has opened new possibilities for personalized learning, adaptive feedback, and data-informed instruction (Holmes et al., 2019). These technologies promise to address long-standing educational challenges such as differentiated instruction and individual learning support, offering dynamic systems that adjust content and feedback based on learner performance. However, the effective

use of AI in education requires not only technological readiness but also pedagogical understanding, ethical consideration, and digital literacy among both teachers and students (Luckin et al., 2022).

The conceptual foundation of AI in education draws on constructivist and socio-cognitive learning theories, which emphasize learners' active engagement in building knowledge through reflection and interaction. Adaptive learning systems, often implemented as Intelligent Tutoring Systems (ITS), use machine learning algorithms and continuous formative assessment to personalize instruction based on students' knowledge levels and progress. Recent systematic reviews (e.g., Létourneau et al., 2025; Zawacki-Richter et al., 2019; Okonkwo & Ade-Ibijola, 2021) demonstrate that such systems, along with recommender algorithms and conversational agents, can enhance engagement, metacognitive awareness, and learner autonomy when pedagogically aligned with instructional goals. These tools analyze learner data to generate individualized learning trajectories, offering timely, data-driven feedback that supports self-regulation and motivation. However, researchers consistently caution that technology alone does not ensure meaningful learning. Overreliance on automated systems can reproduce inequities if students lack digital confidence or interpretive scaffolding. Therefore, scholars increasingly emphasize a human-centered AI perspective, in which technology acts as a supportive, rather than substitutive element of pedagogy (Holmes et al., 2019; Luckin et al., 2022).

Most empirical evidence on the educational use of AI-powered chatbots comes from STEM disciplines. Research in language learning is more limited but indicates positive effects on writing accuracy, communicative competence, and learner motivation (Huang et al., 2021; Belda-Medina & Calvo-Ferrer, 2022). However, several studies (e.g., Liang et al., 2023) caution that linguistic inaccuracies, cultural bias, and limited lexical models can lead to contextually inappropriate or misleading feedback. Despite the growing body of research on chatbots for language learning, most studies focus on foreign or second language contexts, while empirical evidence on their use in native language instruction remains scarce. Consequently, their application in native language education remains largely unexplored, particularly in low-resource linguistic contexts such as Macedonian, where challenges of lexical precision, orthographic variation, and contextual understanding persist. For this reason, localized research on AI-assisted learning in small language communities is essential to identify the linguistic constraints of such systems.

In addition to linguistic limitations, several pedagogical and psychological factors influence how students engage with AI tools. Learners' trust in automated systems, perceptions of privacy, and willingness to rely on digital feedback mechanisms significantly shape their adoption of AI-supported learning environments (Zhang et al., 2025). Recent studies show that while students often appreciate the immediacy and accessibility of AI-generated feedback, they remain cautious about its accuracy, fairness, and transparency when compared to human evaluation. This tension between technological efficiency and pedagogical authenticity underscores the importance of teacher mediation and contextual adaptation. AI systems achieve their greatest educational value when embedded within broader learning ecosystems that emphasize reflection, dialogue, and human oversight (Luckin et al., 2022).

The intersection between AI and teacher education is particularly critical. As future educators, university students in teacher-training programs must not only acquire subject-specific knowledge but also learn how to critically evaluate and implement educational technologies. The OECD (2023) notes that preparing teachers for AI-enhanced education requires both confidence in using digital tools and a reflective understanding of their limitations. In this context, pilot studies that introduce AI tools into teacher education, including the present study, serve a dual purpose: they provide insight into learning outcomes while simultaneously building digital readiness among future educators.

Method

This study employed a comparative, quasi-experimental research design to examine the effect of chatbot-assisted learning on student performance in the course *Macedonian Language and Culture of Expression 2.* Two cohorts of second-year students in the Primary Education Program at the Faculty of Pedagogy "St. Kliment Ohridski" – Skopje were compared: an experimental group that used an AI-powered chatbot and a control group from the previous academic year that completed the same course with the same instructor but without access to AI tools. The experimental group consisted of 32 undergraduate students enrolled in the 4th semester, who volunteered to use the AI chatbot. However,

only 11 students actively used it during the semester, with varying frequency and depth of engagement. The control group consisted of 13 students from the previous academic year. The difference in group size reflects normal variations in enrollment rather rather than a sampling bias. Additionally, the voluntary nature of chatbot use among the experimental group aligns with authentic higher education practices, where technology adoption depends on students' motivation, readiness, and perceived usefulness.

The chatbot, developed using the SchoolAI platform, provided topic-specific guidance, explanations of linguistic and stylistic concepts, and practice exercises. Quantitative data were collected through continuous assessment tests administered during the semester, written assignment, the final exam, and oral examinations, while qualitative insights were obtained from informal feedback and reflective comments gathered during and after the course. The experimental group was introduced to the chatbot at the beginning of the semester and encouraged to use it as a supplementary tool for independent study and practice. No explicit grading or credit was associated with chatbot use. The control group, from the previous academic year, followed the same course structure, assessments, and instructional approach. After the semester, comparative analysis of academic outcomes between the two groups was conducted.

Data analysis

Quantitative data were analyzed using Welch's t-test to account for differences in group sizes and variance, comparing the mean academic performance between students who used the chatbot and those who did not. Descriptive statistics were used to illustrate patterns in chatbot engagement and outcomes. Qualitative data were thematically interpreted to capture students' perceptions of the chatbot's usefulness, linguistic accuracy, and limitations.

Findings

The results obtained from the quantitative and qualitative analyses are presented in this section. The analysis aims to evaluate how the use of an AI-powered chatbot influenced students' academic achievement, engagement, and perceptions during the course Macedonian Language and Culture of Expression II. The presentation of results is structured into four parts: quantitative outcomes comparing the experimental and control groups, qualitative insights from student feedback, a discussion integrating both dimensions, and illustrative examples of linguistic errors observed in the chatbot's Macedonian language output.

Quantitative Findings

The results of the comparative analysis between the experimental group (students who used the AI-powered chatbot) and the control group (students from the previous academic year) are presented in Table 1. A Welch's t-test was applied to account for unequal variances between the two groups.

Table 1.
Results of Welch's t-test comparing the experimental and control gropus

Variable	Group 1 (AI Chat bot)	Group 2 (Control)
Mean	67.00	54.77
Variance	645.60	179.36
N	11	13
t (welch)	1.44	
df	15	
p (two-tailed)	0.171	

Note: No statistically significant difference was found ($p > 0.05$). However, the effect size (Cohen's $d \approx 0.60$) indicates a moderate positive effect.

The experimental group achieved a higher mean score ($M = 67.0$) compared to the control group ($= 54.77$),), suggesting a positive trend in academic performance associated with chatbot use. Although this difference did not reach statistical significance ($t = 1.44$, $p = 0.171$), the effect size (Cohen's d $\approx$ 0.60) indicates a moderate practical impact. This suggests that, while the sample size may have limited statistical power, the use of the chatbot may meaningfully influence learning outcomes. The relatively

high variance within the experimental group (645.6) also points to varying levels of engagement and effectiveness, possibly reflecting differences in how actively individual students interacted with the AI tool.

period to better capture the long-term pedagogical effects of chatbot-assisted instruction.

Overall, the quantitative results indicate that AI-assisted learning had a positive but not yet conclusive impact on student achievement. These findings justify further investigation with a larger sample and extended implementation period to better capture the long-term pedagogical effects of chatbot-assisted instruction.

Qualitative Findings

Qualitative data collected through informal feedback and reflective comments revealed several key themes regarding students' interaction patterns, attitudes, and perceptions of the AI chatbot.

- Out of 32 students who had access to the chatbot, only 11 used it at any point during the semester, and even among them, only three students engaged with it regularly and in greater depth. The remaining users interacted with the chatbot only occasionally, typically before tests, during assignments, or when encountering specific linguistic difficulties. This uneven pattern of adoption suggests that the impact of the chatbot on learning outcomes depended largely on the intensity and continuity of engagement, rather than on the mere availability of the tool.
- Students who interacted more frequently reported that the chatbot helped them clarify grammatical and stylistic uncertainties, and they appreciated the immediacy of feedback that supported independent learning between classes.
- However, several users expressed privacy concerns, fearing that their chat histories could be reviewed by the instructor.
- Importantly, a number of students noticed that the chatbot occasionally produced errors or inconsistencies in Macedonian language usage, particularly concerning morphological agreement, orthographic precision, and stylistic naturalness. This observation highlights the linguistic limitations of AI tools in low-resource languages and emphasizes the need for continuous localization and refinement.

Another key finding relates to students' expectations of how learning support should function. Some students expected the chatbot to provide direct solutions rather than scaffolding or guiding them toward understanding. When the chatbot encouraged reflection or partial self-correction, these students expressed frustration and perceived it as "unhelpful". Such reactions reveal a preference for answer-oriented learning and limited tolerance for cognitive challenge. This finding aligns with broader pedagogical observations that successful integration of AI tools requires promoting metacognitive awareness, persistence, and self-regulation among learners.

Overall, the qualitative data show that the educational value of AI-assisted learning depends not only on the technological quality of the system but also on the learners' attitudes, engagement patterns, and linguistic trust in the tool. Students who approached the chatbot as a reflective learning aid benefited most, while those who sought quick answers or encountered linguistic inaccuracies perceived limited usefulness. These insights underscore the importance of pedagogical scaffolding, digital literacy development, and continued improvement of Macedonian-language AI models to enhance the overall effectiveness of AI-supported learning.

Discussion

The combined quantitative and qualitative results provide a nuanced understanding of how the integration of an AI-powered chatbot influenced students' learning outcomes and engagement in Macedonian language instruction. The findings reveal a moderate but not statistically significant effect, accompanied by a high variance within the experimental group. This high variance statistically reflects the uneven adoption patterns identified in the qualitative findings, where only a few students engaged consistently with the chatbot while the majority used it sporadically or not at all. Consequently, the variation in usage intensity appears to have directly contributed to the dispersion of academic results.

From a pedagogical perspective, the results suggest that AI-based learning tools can be effective only when students are guided and motivated to use them regularly and purposefully. The moderate effect size (Cohen's d ≈ 0.60) indicates that meaningful improvements are possible, but these improvements are contingent upon learner engagement and the perceived usefulness of the tool. This aligns with previous research emphasizing that the pedagogical impact of AI is mediated by trust, motivation, and self-regulated learning (Luckin et al., 2022; Zhang et al., 2025).

The study also highlights the importance of human-centered AI design in education. Students' privacy concerns and skepticism regarding linguistic accuracy demonstrate that technological solutions alone cannot guarantee learning gains. Instead, they must be accompanied by transparent communication, ethical design principles, and teacher mediation that foster digital trust and contextual understanding. The observed linguistic errors made by the chatbot, especially in morphology and stylistic precision, further underscore the need for localization and linguistic adaptation when applying AI tools to low-resource languages such as Macedonian.

Another key implication relates to students' expectations about the learning process. Some participants perceived the chatbot as ineffective because it did not provide ready-made answers. This attitude reflects a broader pedagogical challenge: fostering metacognitive engagement and productive struggle in technology-enhanced environments. As the literature suggests, the educational value of AI lies not in automating solutions but in supporting reflection, exploration, and self-directed reasoning (Holmes et al., 2019; Zawacki-Richter et al., 2019).

Overall, these findings reaffirm that the successful integration of AI into higher education requires more than access to tools. It demands pedagogical adaptation, digital literacy development, and an iterative feedback loop between technology and instruction. When students are encouraged to engage with AI critically and consistently, chatbots like SchoolAI can meaningfully contribute to personalized learning and language development. Conversely, when used passively or sporadically, their potential remains underutilized.

Illustrative Examples of Linguistic Errors Produced by the Chatbot

To further illustrate the linguistic limitations of the AI chatbot in processing the Macedonian language, several categories of errors were identified based on students' observations and the analysis of chatbot outputs. These examples reflect typical weaknesses of large language models when applied to morphologically rich and syntactically flexible languages, such as Macedonian.

Table 2.

Representative Examples of Linguistic Errors Produced by the Chatbot

Ex.	Type of Error	Chatbot Output	Correct Form	Explanation
1	Mixing Cyrillic and Latin scripts	*временska, сакаş*	*временска, сакаш*	The chatbot occasionally combines Cyrillic and Latin characters within a single word, resulting in visually and orthographically incorrect forms.
2	Use of non-Macedonian words (Serbian, Bulgarian, Russian)	*цвеќа, бројот, с остоянието, число, реч*	*цвеќиња, бројот, состојбата, број, збор*	Lexical interference occurs due to similarities with other South Slavic languages, leading to incorrect borrowing of foreign word forms.
3	Incorrect grammatical terminology (Anglicized or foreign terms)	*адјектив, субјект, предикат*	*придавка, подмет, прирок*	The chatbot replaces standard Macedonian linguistic terms with Latin-based or English-influenced terminology.
4	Morphological and orthographic errors	*добредојде, предходно, представник, грашак, пантолони*	*добре дојде, претходно, претставник, грашок, панталони*	The chatbot occasionally produces spelling inconsistencies and orthographic errors that deviate from the standard Macedonian form,

				reflecting incomplete orthographic normalization in its language model.
5	Misinterpretation of collective and enumerated plural forms	*даба, жара, ѕида*	*дабје, жарје, ѕ идје*	The chatbot fails to distinguish between regular, enumerated, and collective plural, a feature specific to Macedonian grammar.
6	Incorrect gender assignment in dual-gender nouns	*кал (masc. only), вар (fem. only), песок (masc. only)*	*кал, вар, песок (dual-gender)*	The chatbot incorrectly assigns fixed gender values to nouns that in Macedonian can belong to both masculine and feminine gender, depending on context and usage. This error reflects a lack of grammatical sensitivity to dual-gender nouns, a distinctive feature of Macedonian nominal morphology.

These findings demonstrate that most linguistic errors stem from cross-linguistic interference, inconsistent orthographic encoding, and incomplete morphological modeling. The chatbot frequently mixes Cyrillic and Latin characters, uses terminology borrowed from other Slavic or Western languages, and struggles to generate correct plural and gender forms typical of Macedonian grammar. Such inconsistencies confirm that existing large language models have limited language-specific optimization for Macedonian, emphasizing the need for localized corpus development, morphological fine-tuning, and targeted evaluation of AI systems in under-resourced linguistic environments.

Conclusion

This study explored the pedagogical implications of integrating an AI-powered chatbot (SchoolAI) into university-level instruction of Macedonian Language and Culture of Expression. By combining quantitative and qualitative data, it provided insight into both the measurable and experiential aspects of AI-supported personalized learning in a low-resource language context.

The results demonstrated that while the chatbot had a moderately positive effect on student performance (Cohen's $d \approx 0.60$), the difference was not statistically significant. This outcome largely reflects the uneven adoption and engagement patterns among students: only 11 out of 32 used the chatbot, and just three students engaged with it consistently throughout the semester. The high variance in the experimental group quantitatively mirrors these behavioral differences, underscoring that the impact of AI tools depends not merely on their introduction but on sustained and meaningful use.

Qualitative findings further revealed that students perceived the chatbot as a useful supplementary aid for practicing grammar, receiving instant feedback, and studying independently. However, issues of trust, privacy, and linguistic accuracy limited broader adoption. The detection of errors in Macedonian morphology and stylistic usage confirmed the challenges of applying AI models to low-resource languages, highlighting the need for linguistic localization and corpus-based refinement. Moreover, some students approached the chatbot with expectations for ready-made answers rather than guidance, revealing the importance of fostering reflective and metacognitive engagement in AI-mediated learning.

In conclusion, this research confirms that AI-powered chatbots can meaningfully enhance language learning when accompanied by pedagogical scaffolding, clear usage guidelines, and teacher mediation. Their success depends on creating an environment where learners are encouraged to use AI tools critically, ethically, and consistently. For Macedonian and other less-resourced languages, future work should prioritize developing localized language models, improving the quality of automated linguistic feedback, and conducting larger-scale studies to validate the observed effects. Ultimately, the integration of AI in teacher education holds transformative potential, but its realization requires balancing technological innovation with human-centered pedagogy.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were fully observed. No actions violating

scientific research and publication ethics were undertaken. The authors confirm that there is no conflict of interest among them and that all have equally contributed to the research and manuscript preparation. Full responsibility for any ethical issues rests with the authors.

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Data Availability Statement: The anonymized data supporting the findings of this study (exam scores and aggregated chatbot usage statistics) are available from the corresponding author upon reasonable request.

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Educational History Game Design Challenges: Human insights vs Generated Suggestions

Chrysa Tamisoglou[1]

Abstract

This paper presents a comparative study on the design of educational history board games by university students and large language models (LLMs) such as ChatGPT, Gemini, and DeepSeek. The purpose of the study is to explore the creative potential of generative AI in the field of educational game design, particularly in the context of history education. A group of students was tasked with designing board games that familiarize young players with the promotion of national benefaction and its link to national history. In parallel, the same prompts were given to several LLMs to generate similar game concepts/suggestions. The study evaluates both human and AI-generated produced designs based on criteria such as historical accuracy, creativity, aesthetic and visual design, educational value, and playability. Through this comparison, the study aims to explore the strengths and limitations of AI-generated suggestions in educational (history) game contexts, and how they differ from the human-driven process of game design. The findings reveal important insights into the role of AI in supporting or enhancing creative tasks in (history) education, as well as the potential impact of AI on pedagogy in general. This paper highlights the evolving relationship between human creativity and artificial intelligence, suggesting avenues for future research in AI-assisted game-based learning. The results contribute to the understanding of how AI can be integrated into educational design processes, offering new perspectives on modified board games in history education.

Keywords: History broad games, educational game design, AI-generated designs, AI-assisted game-based learning.

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Introduction

Several modern pedagogical approaches have emerged in the field of history education so as history teaching and learning to attract students' interest and engagement. Among these approaches, game-based learning has emerged as a dynamic field, offering learners opportunities to engage with historical content through exploration, decision-making, and structured play. While digital games dominate the field, board games continue to be employed in educational contexts due to their accessibility, social interactivity, and adaptability. Board Game-Based Learning (BGBL) has, therefore, gained relevance as educators explore meaningful ways to cultivate historical knowledge, critical thinking, and civic-oriented attitudes through active engagement with the past.

At the same time, artificial intelligence (AI), particularly large language models (LLMs), have be embedded into educational design processes, including the development of pedagogical materials and learning activities. As AI tools become increasingly user-friendly and widely available, educators and researchers have begun exploring them not only as means that can facilitate performing creative and instructional tasks but also as partners in such tasks. Recent scholarship suggests that LLMs may contribute usefully to various stages of BGBL design; however, questions remain regarding the extent to which AI-generated suggestions can parallel or complement the contextual depth, historical consciousness, and pedagogical intentionality embedded in human-designed games.

On the ground of these questions, this study examines the interplay between human creativity and AI-generated proposals in the design of an educational history board game. The project focuses on the work of the History Apprenticeship Group (HAG), whose members developed Glyptopoly, a board game inspired by Monopoly and rooted in the local history of Ioannina, particularly its tradition of benefaction and its public monuments. In parallel, the same design prompts were provided to several LLMs—ChatGPT, Gemini, and DeepSeek—to generate comparable game designs. Through a comparison of these human- and AI-produced designs, this study seeks to identify both the possibilities and limitations of AI-assisted creativity within the domain of educational history game design.

Literature Review

Since antiquity, games—and board games in particular—have been regarded as valuable tools for socialization, ritual expression, and intellectual development. In contemporary educational research, the significance of games has been extensively examined and established as a fundamental component of effective teaching and learning. Unlike traditional teaching methods, games position learners as active agents in constructing their own knowledge allowing them to explore concepts, test hypotheses, and reflect on consequences within a stimulating and safe environment (Plass et al., 2015). Research supports the view that games can serve as powerful pedagogical tools that facilitate cognitive, social, emotional, and physical development (Zosh et al., 2017). They additionally promote intrinsic motivation, critical thinking, and essential 21st-century skills, such as collaboration, decision-making, and strategic reasoning (Wild, 2024; Plass et al., 2015).

Although digital games have received increasing attention, board games continue to serve as a valuable and versatile educational tool for enhancing learning. Board games offer a wide array of pedagogical advantages: they promote collaborative learning, involving knowledge exchange, the negotiation of solutions, and the cultivation of communication and teamwork skills (Berland & Lee, 2011); they encourage healthy competition, which can motivate students to excel and foster the development of problem-solving skills within an engaging and challenging context (Plass et al., 2013); they generate a sense of shared experience or "togetherness" (Calleja, 2022), which encourages self-expression and risk-taking in a supportive environment (Suits, 2014). Board games also operate as "transparent systems," wherein their rules and interactive dynamics are visible and open to players' exploration—enabling engagement with complex, nonlinear systems in ways that other media may not afford (Zeijlemaker et al., 2022). Moreover, board games are highly adaptable and can be easily modified or personalized to align with specific learning objectives (Tinterri et al., 2024).

The pedagogical advantages evidenced through the integration of games into the learning process have led to the evolution of the Game-Based Learning (GBL) framework. Grounded in the constructivist theories of Jean Piaget and Lev Vygotsky - both of whom underscored the pivotal role of play in

cognitive development and overall learning - GBL employs games as primary vehicles for achieving specific educational outcomes. The approach is further shaped by James Paul Gee's (2003) influential learning principles, which argue that well-designed games embody effective educational mechanisms. These include identity formation, whereby players/learners adopt roles within the game environment to think and act as domain experts; situated meaning, which situates learning within meaningful contexts; and systems thinking, where learners engage with complex, interconnected structures. Moreover, GBL aligns with experiential learning, encouraging students to construct knowledge through active inquiry, participation, and reflection. Contemporary GBL research increasingly emphasizes the transfer of knowledge from game environments to real-world contexts (Plass et al., 2020). As a subset of GBL, Board Game-Based Learning (BGBL) not only aligns with the core principles of GBL but also capitalizes on the distinct pedagogical characteristics of board games. BGBL offers unique educational affordances: it fosters face-to-face collaboration, tangible and hands-on interaction, and embodied learning experiences that are often more socially engaging and participatory than other game formats.

Regarding history teaching and learning, BGBL is particularly valuable because it allows learners to actively engage with past events, social systems, and historical dilemmas. Through board games, students can experience historical processes in an interactive and meaningful way, assuming roles of historical actors, negotiating political or economic decisions, and responding to contextual challenges (Hellerstedt & Mozelius,2024; Nihan et al, 2023; Ilić Rajković et al, 2020). They could also cultivate historical empathy and understanding of the limitations of archival collections (Hoy, 2018). The research conducted by Hellerstedt and Mozelius (2025) examined university students' perceptions on the didactic potential of historical games as learning tools. The study concluded that students specified several different learning affordances: games can motivate and facilitate the learning of basic facts, such as geography, dates, events and biographies of famous personalities. On a more advanced level, games are well suited for teaching structural explanation. However, they can also, according to the students, provide historical empathy and a subjective experience of the past.

A wide range of commercial educational board games covering historical content is available both in physical stores and online. However, research emphasizes that custom-built and/or modified board games, especially those created by students, offer distinct pedagogical advantages within BGBL. Ilić Rajković et al. (2020), who examined the students board-game creators' perspectives, report that creating a board game was a challenge that required sophisticated intellectual, emotional engagement, knowledge of history problem-solving, social and organizational skills, as well as skills and abilities to present the knowledge, information or given content through a board game. Students-creators recognized the advantages of learning history through creating board games in terms of affecting the quality of knowledge (acquiring more permanent and applicable knowledge), improving the process of learning (different and interesting approach to learning, more spontaneous, through identification, through play and emotions), encouraging engagement and motivation for further learning and improving atmosphere and social relations among students (p.16). Similarly, Hoy (2018) found that incorporating a custom-built board game created by his students into his history teaching demonstrated not only the pedagogical viability of such games for teaching historical content but also their capacity to foster historical empathy and introduce students to research methodologies. In the same vein, in their research, Kesuma et al. (2020) asked their students to create their own historical board games. Using experimental and control class, they tested students' creation against creativity and student learning outcomes. They concluded that board game design made students develop their creativity, think critically, and skillfully investigate, infer material, and connect with real-world problems (p.1697).

In contemporary educational contexts, the rapid emergence of artificial intelligence (AI) and the widespread accessibility of user-friendly tools for large language models (LLMs) have significantly influenced pedagogical practices, including the teaching of history. Tinterri et al. (2024) argue that these technologies introduce a new spectrum of possibilities for supporting teachers in the design and implementation of BGBL. Focusing on ChatGPT, Tinterri et al. (2023) demonstrate that LLMs can effectively assist multiple stages of BGBL design, particularly in selecting appropriate games based on learners' characteristics and needs, aligning gameplay with defined educational objectives, and personalizing both in-game and around-game elements to enhance constructive alignment between an existing game and targeted learning goals. In their more recent study, Tinterri and his colleagues (2024)

evaluated the reliability, effectiveness, and contextual sensitivity of several LLMs—such as Copilot, Claude, and ChatGPT—for adapting existing board games to diverse classroom scenarios. Their findings suggest that, when provided with clear and sufficiently detailed instructions, contemporary state-of-the-art LLMs can serve as valuable tools for managing the complex task of personalizing games for BGBL instructional design. Notably, the models generated personalization proposals comparable to those of human experts in terms of disciplinary alignment, pedagogical feasibility, and inclusivity.

Building on the aforementioned context, the present study reports on a project in which a group of students was tasked with designing board games related to local history. In parallel, the same design prompts were provided to several LLMs to generate comparable game concepts and suggestions. By evaluating both the human-produced and AI-generated designs, the study seeks to examine the strengths and limitations of LLM-generated contributions to educational (history) game design and to identify the ways in which these outputs diverge from the human-driven creative and pedagogical design process.

Background of the project

History Apprenticeship Group (HAG) consists of students who wish to deepen their knowledge and competences in terms of history as content and its teaching. The group focuses on general and local history. It searches for innovative teaching approaches to make historical knowledge easily accessible and enjoyable to primary school pupils.

Within the context of their engagement with local history, public sculptures/monuments related to history emerged as central of their historical inquiry. As part of their fieldwork, students conducted a city walk in Ioannina to identify and map history- related public statues/monuments located in public spaces. A comprehensive list of all public sculptures/monuments was compiled. Next, students collected historical information for each entry on the list, including relevant historical events, creators, social reception etc. Once the historical data were gathered, students studied them aiming to address the guiding question: “How does the past ‘relive’ in public spaces?”. The findings indicated that the majority the public sculptures/monuments commemorate prominent local personalities renowned for their benefaction/philanthropy and important contribution to local community. In parallel, their fieldwork highlighted the issue of vandalism and neglect affecting many of the public historical statues/monuments listed. Motivated by their findings, the HAG members sought to transform the collected data into engaging learning experiences that would raise students’ awareness of the identified issues. At that point, they were required to confront their first challenge.

1st Challenge

Their first major challenge could be summarized in the following guiding question: “In what effective way could public historical sculptures/monuments be utilized to offer an enjoyable and at the same time valuable educational experience in history classroom?”. After a series of brainstorming sessions, the HAG conceived the idea of developing an educating board game designed to cultivate relevant attitudes and behaviors — such as benefaction, contribution to local community, and the prevention of vandalism of public historical monuments-which they found aligned with their overall aims. Despite their enthusiasm, they realized that their competences and knowledge in educational board game design were not sufficient for such an endeavour. Nevertheless, they decided to draw inspiration from popular commercial games, adopting their structure and mechanisms to serve their educational aims.

Monopoly was among the commercial board games considered; it appeared to be a convenient choice. Monopoly incorporates a range elements that could be effectively aligned with the cultivation of the target attitudes and behaviors. Specifically, it involves public spaces, accommodates multiple players, integrates economics themes-reflect the fact that benefactors possessed considerable wealth and made donations-. Additionally, its design includes the construction of buildings in public spaces, as well as “Chance” and “Community chest” cards which could be creatively interpreted. Based on those advantages, HAG designed, created and pilot tested an interpreted version of Monopoly called Glyptopoly (γλυπτό (glypto) in Greek means statue/ Glyptopoly means the city of statues).

HAG members designed their own board game inspired by Monopoly playout, but replacing its properties with public squares of the city (Figure 1). The players assumed the role of local benefactors who were identified during city walk. Their figures were illustrated, and relevant biographical information was provided (Figure 1).

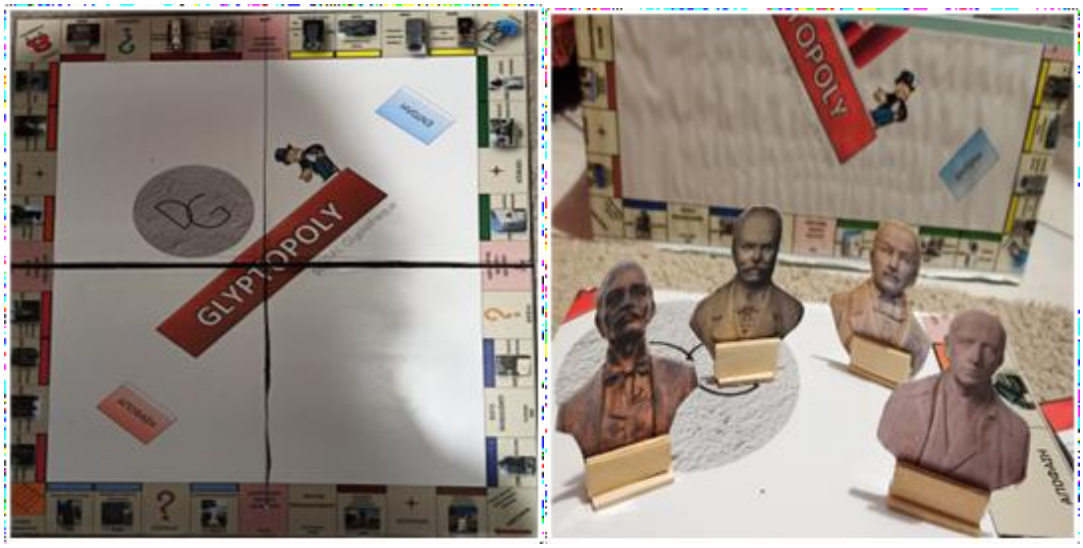


Figure 1. *Glyptopoly's board and players' figures*

"Chance" and "Community chest" cards were edited. Their content reflected themes such as the promotion of local community interest and donations, the erection of historical statues and monuments, prevention and maintenance of public historical constructions, and campaign against their vandalism (Figure 2). Instead of roads/avenues, title deeds corresponded to public squares and landmarks (Figure 2).



Figure 2. *'Chance" and "Community chest", Title Deeds, Statues and Momuments*

Players- acting as benefactors- were expected to invest their money in the construction/prevention/restoration of statues/monuments in public spaces. Game instructions were carefully compiled to reflect educational goals. The winner of the game was the player who was successful in possessing the greatest number of public spaces and sculptures/ monuments/memorials.

After completion, Glyptopoly was pilot tested among the members of HAG and was implemented both within and beyond school settings. The feedback was really encouraging, and students expressed satisfaction with the result. Soon, a second challenge emerged.

2nd Challenge

Since AI has become an increasingly influential component in educational settings, the second challenge faced by HAG was framed through the following questions: "Could *Glyptopoly* be improved using LLMs? What additional features could LLMs contribute to *Glyprotpoly*? What is missing from the game

that could make it more appealing?". To address these guiding questions, the HAG decided to employ AI tools. The aim behind this decision was to compare their design and creation processes with the generated suggestions by AI. This study reports the findings of this comparison with the view to discuss insights into the role of AI in supporting or enhancing creative tasks in (history) education, as well as the potential impact of AI on pedagogy in general.

Method

In order the comparison to take place, large language models (LLMs) were employed, especially ChatGPT, Gemini, and DeepSeek (free version). The use of more than one LLM was considered appropriate for this purpose as it allowed a broader range of generated suggestions. The prompt below was compiled and submitted to the chat box of each model: *"Create a board game that follows the structure and rules of the Monopoly board game. The goal of the game should be to promote benefaction in public spaces by enriching squares with monuments, statues, and sculptural ensembles inspired by Greek history. Create the game elements. The "Chance" and "Community Chest" cards should involve benefaction, the maintenance and erection of public sculptures, and the prevention or consequences of vandalism of public monuments. The game board should consist of monuments, memorials, and statues from the city of Ioannina. Create the game board. Create the rules of the game. Name the game 'Glyptopoly'".*

The outputs generated by LLMs as well as any visual materials offered by AI tools were downloaded and saved in separate files. Afterwards, a two-step comparison was conducted: the suggestions generated by each LLM were compared with the outputs of the other models. The comparison against the students' original design of Glyptopoly followed. The latest comparison was based on four key dimensions: a. historical accuracy and local relevance of the content, b. thematic consistency with the ideas incorporated in the prompt, c. creativity and originality of the proposed game layout and elements, and

d. pedagogical value in promoting the attitudes and performances identified by HAG. For each step of the comparison relevant tables were compiled to synthesize the data. Then, the students discussed collectively the tables and the data collected to identify differences, similarities and possible ways that AI-generated suggestion could complement or enhance human insights and creativity in the process of educational game design. Finally, HAG members reached the conclusions.

Findings

Comparison between LLMs

An overview of the outputs can be found in Table 1. All AI-tools incorporated the given prompt offering responses for each of its components. Two out of the three LLMs (ChatGPT and Gemini) generated visual representations of their suggestions while DeepSeek provided highly detailed textual instructions for the game construction without accompanying visuals. The visual materials provided by Gemini offered an alternative game layout while the GhatGPT retain the general structure of the original Monopoly game. The same pattern was observed in the other game elements such as title deeds, "Chance" and "Community chest" cards (Figure 3, 4 & 5). Nevertheless, in the case of Gemini, the connection between the visual materials and the historical background of the city-particularly the local dimension which constituted one of the central aims of the game design- was not clearly established.

Each model selected and suggested different historical figures as players as well as distinct public statues/monuments and spaces. Several of these suggestions were either difficult to be identified or had lacked any connection with the local context. In the few cases where such a connection is detected, it was presented in general terms without any grounded historical background.

Table 1. *LLMs suggestions*

	Materials provided
ChatGPT	Textual and visual materials provided Brief instructions for the playout A couple of ideas/options for each part of the prompt offered

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Gemini	Textual and visual materials provided Brief instructions for the game materials Some examples for each part of the prompt offered
DeepSeek	Only textual materials Provided Too descriptive /almost step by step design guide Interesting suggestions offered

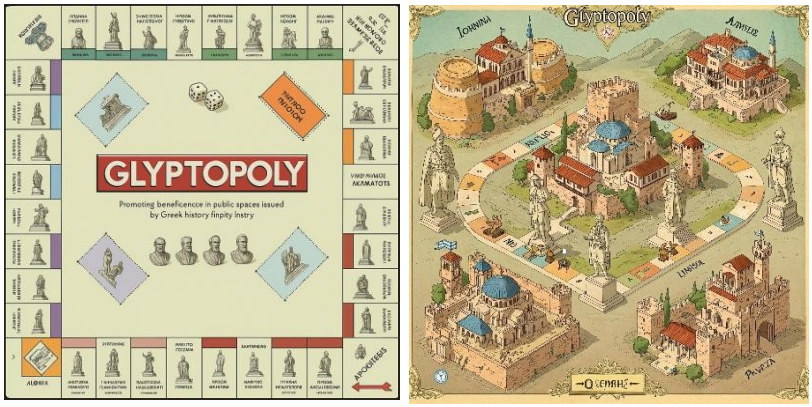


Figure 3. Boards suggested by ChatGPT and Gemini respectively



Figure 4. *Title Deeds suggested by ChatGPT and Gemini respectively*



Figure 5. *"Chance" and "Community Chase" cards produced by ChatGPT and Gemini respectively*

Regarding DeepSeek generated suggestions, the detailed instructions offered a conceptual outline of the game layout and a conceptual design of the game elements (Figure 6). Embedded within the textual instructions, the model included some provoking quotes without any further guidance and explanation on how these quotes could be incorporated into the overall game design (Figure 7).

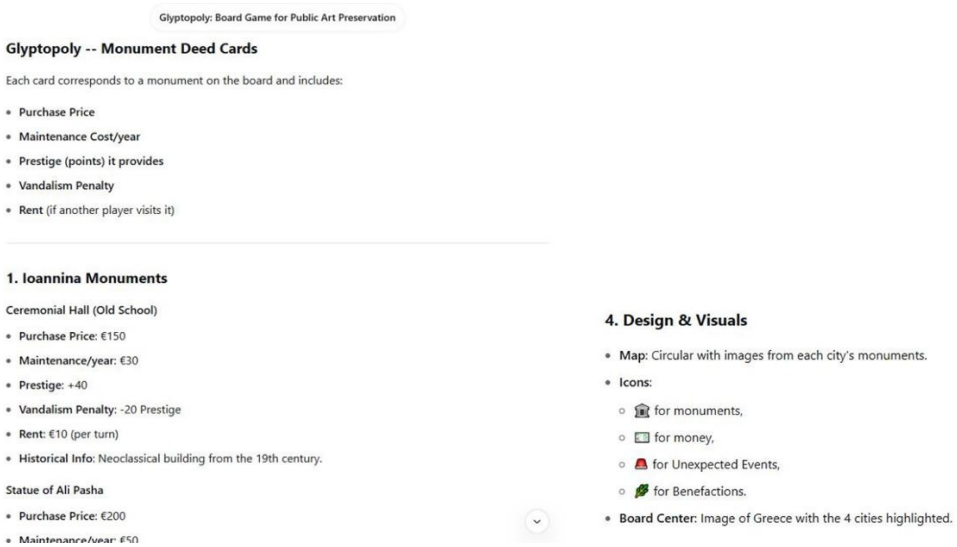


Figure 6. *Game layout instructions provided by DeepSeek*

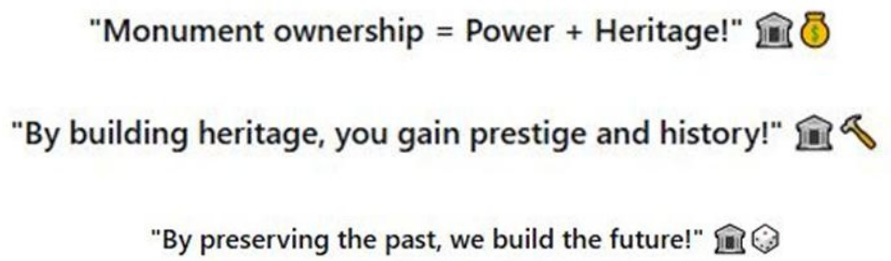


Figure 7. *Quotes embedded into DeepSeek generated suggestions*

To sum up, each model according to its design and capabilities, generated suggestions that adhered to the prompt to a certain extent. The original Monopoly game served as their starting point; however, each model adopted it in the ways that reflected its own interpretation of the prompt. The LLMs focused primarily on the structural and mechanical aspects of the game construction while less attention was paid on the educational dimension of the task and even less to the historical context and content.

Comparison against students' design

As stated previously, this step of comparison was based on four key dimensions:

a. historical accuracy and local relevance of the content. Drawing on their fieldwork, HAG's member incorporated comprehensive historical data and local perspectives of the city into their version of the game. In contrast, AI-generated suggestions lacked grounded historical background and

frequently generalized or idealized historical content. In several instances, the suggestions demonstrated inaccuracies or inconsistencies in terms of the local context. For example, DeepSeek proposed the inclusion of the statue of Ali Pasa- an actual historical figure and Ottoman commander of the region- even though HAG no such statue cannot be found anywhere in the region. In the same vein, the biographic information of the benefactors-players was often incomplete and, more importantly, disconnected from their philanthropic actions and local contribution. Overall, AI-versions showed limited understanding of the nuanced social meaning attached to the public statues/monuments in the city of Ioannina.

b. thematic consistency with the ideas incorporated in the prompt. HAG's version of the game remained adhered to the thematic orientation of the game as well as to its educational aims. All LLMs versions demonstrated partly consistency with the ideas incorporated in the prompt. While core concepts such as benefaction, public monument preservation and social contribution were embedded into their versions, these values/attitudes were treated rather superficially or symbolically rather than included in a meaningful manner in the game. For instance, benefaction was reinterpreted merely as financial generosity rather than a moral duty and responsibility to the motherland and city of birth. As a result, LLMs versions were successful in fulling the formal requirements of the prompt; however, they did not fully address the ethical and educational intensions of the game. An interesting exception was noticed: concerning the characteristics of the benefactors-players, DeepSeek's version proposed a dimension that has not been incorporated into the HAG's version. This model proposed the notion of players' prestige referred to the widespread respect and admiration felt for benefactors based on the perception of their significant achievements or personal qualities. This suggestion was considered both significant and consistent with the orientation of the game. It was therefore as a valuable addition to the game which constituted a substantive improvement to the original concept.

c. creativity and originality of the proposed game layout and elements. The layout and elements proposed by the three LLMs demonstrated variation. ChatGPT's version closely followed the pattern of the original Monopoly game while included customized components based on the given prompt. Gemini's version displayed interesting visual elements; it proposed aesthetically appealing elements such as layouts, board and cards. Despite their aesthetic appeal, they raised questions about how effectively reflect the local context and convey a sense of connection to the local environment and context. More specifically, the generated elements seemed to depict a medieval city than the specific urban and historical landscape of Ioannina. Although less detailed in the sense of visual presentations, DeepSeek's version adhered more closely to the original pattern of Monopoly game, providing textual instructions instead. On one hand, these instructions could be considered as an open-ended prompt stimulating creator's imagination; on the other hand, their abstract and interpretative manner could lead to misconceptions and misunderstandings in implementation. Overall, while the AI-generated versions varied in creativity and originality, they demonstrated the potential of LLMs to introduce perspectives and ideas that can enrich human insights.

d. pedagogical value in promoting the attitudes and performances identified by HAG. As stated earlier, the ultimate intention of Glyptopoly was to promote attitudes and performances such as respect to historical public artifacts, promotion of ethical responsibilities and social/local commitment, and cultivation of civic engagement. The implementation of Glyptopoly to indoor and out-door school settings reflected (school) students' efforts to engage with the moral and social dimensions of benefaction, the significance of preserving local monuments, and the appreciation of the contributions of historical benefactors to their city's identity. In comparison, AI-generated outputs demonstrated limited pedagogical orientation. Although they adjusted the original game to the requirements of the prompt, the emphasis on the educational aims was not explicit. The introductory statements the LLMs responses clearly articulated pedagogical/educational intensions. However, a closer examination of the proposed game elements revealed an emphasis on entertainment and structural fidelity to Monopoly. Consequently, the emotional and reflective components highlighted in Glyptopoly- those intended to promote historical consciousness and civic-orientated thinking- were often absent. The introduction of the notion of prestige as well as the open-ended textual instructions mentioned earlier could be considered as positive indicators of emerging pedagogical potential. In conclusion, the LLMs suggestions revealed possibilities and opportunities for human insights enrichment.

Discussion, Conclusion, and Suggestions

This study involves a comparative analysis between Glyptopoly- developed by HAG's members- and the AI generated suggestions. The distinct and complementary capacities of human insights and generated suggestions underscored through the analysis. The human-design version was grounded in contextual authenticity, historical accuracy and pedagogical intentionality. It was the product of creators' deep understanding of the cultural and ethical dimensions of benefaction and public historical heritage and their deep desire to translate them into tangible educational experiences. The students' engagement with local history through Glyptopoly demonstrated the enhancement of historical knowledge, the cultivation of attitudes such as empathy, civil and ethical responsibilities- essential elements in contemporary history education.

The results produced by LLMs showcased the remarkable capacities of AI in organization, aesthetics, and structural design. However, the understanding of the educational purpose and emotional resonance were limited. This leads to the conclusion that the models' capacity to generate structurally sound and aesthetically rich outputs-no matter how technically impressive - does not necessarily equate to meaningful pedagogical value.

The study shows that human creativity fundamentally defines the creative potentials of AI. Human-oriented prompts are indicators of human creativity. They also serve as primary indicators of intentionality and directly shape the nature and depth of LLMs responses. In the case of Glyptopoly, if the objective had been to elicit more educationally purposeful or pedagogically innovative AI-generated suggestions, the initial prompt would have been modified and refined. Thus, the study reinforces the view that meaningful AI-assisted creativity in education depends on thoughtful human prompting, critical interpretation, and pedagogical framing.

Additionally, HAG's engagement with fieldwork, historical research, and hand-on experience fostered an authentic and original understanding of the local environment-both past and present- which was vividly conveyed through the game design procedure. For instance, photographs- taken by students- of on-site vandalized historical public monuments were incorporated into the "Chance" and "Community chase" cards, promoting meaningful discussion among the players. This combination of emotional involvement, experiential learning and explicit tangible evidence of the local atmosphere contributed significantly to the educational impact of Glyptopoly. Such contextual sensitivity and affective engagement were absent from the LLM's versions. Such experiential grounding and emotional depth are essentials in education and particularly in history education.

Nevertheless, the AI-generated outputs offered fresh perspectives and innovative ideas—such as the inclusion of the concept of prestige—which could enhance the moral and motivational dimensions of the game. This point indicates that AI acted as a creative partner, extending the imaginative space of human designers. When used critically and reflectively, such tools can inspire students and educators to reimagine learning materials, test alternative designs, and engage in metacognitive reflection about the nature of creativity, authorship, and historical representation.

The historical inconsistencies and inaccuracies detected signalise that the integration of LLM's in history education- and education in general- requires careful scaffolding to ensure that generated content remains aligned with historical accuracy, local context, and value-based learning objectives. The involved human parties must assume the role of evaluators and curators of AI outputs, engaging in critical dialogue about the appropriateness, accuracy, and ethical implications of the generated materials. The engagement in critical dialogue and evaluation was an important aspect of history education which fosters historical critical thinking.

Concluding, the comparison conducted indicates that meaningful innovation in history educational game design and in (history) education arises from the synergy between human intentionality and machine-assisted creativity. The human agent involved in this synergy must assume the following critical and reflective role: to design frameworks that leverage AI's generative potential while preserving the authenticity, contextual depth, and ethical purpose that characterize human-centered pedagogy. In other words, the intersection of these two forms of design—human and machine—reveals a promising yet complex pedagogical terrain. Understanding how AI-generated ideas can meaningfully support

educational aims without diluting contextual authenticity or human intentionality becomes a crucial area for further reflection and inquiry. When this challenge is effectively addressed, AI-tools and machines may function as a valuable "consultant", playing a supportive rather than substitutive role in educational design.

While exploratory in nature, the analysis presented presupposes certain limitations that should be acknowledged. First, the analysis solely focused on a small sample of LLMs—ChatGPT, Gemini, and

DeepSeek (free version)—whose design parameters, training data, and accessibility may be limited and have influenced the quality and depth of the generated outputs. Also, no follow-up prompts were used to further guide or refine AI's generated suggestions which might have yielded more focused and aligned results. Future research could address these points by employing pro versions of LLMs and implementing iterative prompting strategies that progressively shape the models' output toward desired educational objectives.

Second, the comparison relied on qualitative analysis and group discussion among HAG members. Although this approach ensured authentic student perspectives, it also introduced a subjective dimension, including the potential for bias, as participants may have felt inclined to defend their own design—particularly given the time and effort invested in the creation and implementation of Glyptopoly. Future studies could employ mixed methods approaches, incorporating expert reviews or quantitative rubrics to ensure greater reliability and reduce subjective influence.

The frame of the game design was restricted to a single historical and geographical context—the city of Ioannina—which may constrain the transferability of insights to other local settings. Comparative studies involving diverse local histories could provide a more comprehensive and complex understanding of AI's role in contextualized learning design.

Finally, as AI tools continue to evolve, longitudinal research is needed to explore how sustained engagement with AI-supported creative projects influences students' historical thinking, ethical reasoning, and civic identity. Understanding these long-term impacts will be essential for developing pedagogical frameworks that leverage technological innovation while maintaining a commitment to human-centred learning.

Aknowledgment

Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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The Role of Artificial Intelligence in the Formation of Students' Vocal and Artistic Abilities

Osman Musaoğlu[1]

Abstract

This study examines the role of artificial intelligence (AI) in the formation of students' vocal and artistic abilities within the context of vocal music education. The article primarily focuses on how AI can be integrated into vocal singing lessons to support students' theoretical knowledge, practical skills, and psychological preparation. As one of the most promising contemporary technologies, AI offers innovative opportunities to transform traditional approaches to music education by enabling more individualized, structured, and efficient learning processes.

The study is based on a qualitative descriptive analysis. Relevant literature, conceptual frameworks, and current educational practices related to the use of artificial intelligence in vocal music education were systematically examined. The analysis addresses three fundamental dimensions of AI-supported vocal training: theoretical, practical, and psychological. In the theoretical dimension, AI contributes to structured learning by providing access to instructional content, summaries, and exercises related to vocal techniques such as breathing, resonance, and articulation. In the practical dimension, AI supports the design of individualized vocal exercises, repertoire selection, and step-by-step practice plans, enabling students to develop vocal skills in a conscious and systematic manner. In the psychological and artistic dimension, AI offers guidance for overcoming stage anxiety, enhancing self-confidence, and supporting expressive performance.

The findings indicate that AI can function as an effective assistant-mentor for both students and teachers, facilitating professional development, saving instructional time, and increasing learner engagement. However, the study also emphasizes the importance of critical evaluation, ethical awareness, and pedagogical control in the use of AI, as risks such as bias, misinformation, and overreliance on technology may arise. Based on these findings, the study recommends careful selection of AI-generated content, personalization of learning processes, and the use of visual and digital materials to enhance vocal education. Overall, AI holds significant potential to enrich vocal music education when applied thoughtfully and responsibly.

Keywords: Artificial Intelligence (AI); education, methodology, formation, vocal singing

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Introduction

Artificial intelligence (AI) can participate in all three core components—theoretical, practical, and psychological—that together constitute the comprehensive preparation of a student in vocal music education. With the support of AI, instructional methods applied within these components can become more illustrative, structured, and easier to assimilate. Teaching practices such as observation, demonstration, practical exercises, self-regulation, guided learning, and comparative analysis can all be effectively enhanced through AI-supported tools and applications. As one of the most promising and forward-looking technologies, artificial intelligence has the potential to significantly transform contemporary approaches to music education (Savchenko, 2025), offering new pedagogical opportunities and expanding instructional possibilities (Levin, 2024).

When integrated into vocal singing classes, AI facilitates the development of musical competence among students by enabling more individualized learning processes and faster pedagogical outcomes. At the same time, it provides teachers with opportunities for professional development, instructional planning, and continuous knowledge enhancement.

Based on this framework, the findings section examines three fundamental dimensions of AI-supported vocal education—namely the theoretical, practical, and psychological components—by analyzing their roles, applications, and educational implications in detail.

Method

This study is based on a qualitative descriptive analysis. Relevant literature and conceptual sources on the use of artificial intelligence in vocal music education were examined to describe its theoretical, practical, and pedagogical dimensions.

Findings

Regarding the first component—the theoretical preparation of the student—AI can provide advice or deliver basic music lessons. Opportunities for individualization are offered, allowing students to search for theoretical content they did not understand or may have missed. Through personal creativity, students can learn material in the way they prefer, while AI acts as a mentor and facilitator. AI systems contain ready-made materials on various topics related to the fundamentals of singing, such as breathing, vocal support, resonance, articulation, and others. AI can increase student engagement and contribute to the development of new programs aligned with students' interaction with technology.

Within theoretical preparation, structured learning through AI-based chat interaction is fundamental. Additional capabilities of AI include: creating a complete syllabus (lesson plan), generating summaries, and presenting sample exercises—vocal, auditory, and theoretical. This entire set of possibilities facilitates the teacher's work. If the teacher allows the use of AI in music theory lessons, it can enhance students' knowledge and save time, which can then be allocated to practical exercises. Nevertheless, theoretical knowledge should not be acquired solely through AI. Each theoretical issue requires precision and careful presentation, as the teacher's perspective is crucial in shaping students' understanding in vocal singing courses.

With regard to the second component—the practical exercises—AI can assist in designing individualized vocal exercises. When a question is posed to AI related to creating a daily training program—for example, vocal exercises for intonation—it provides a range of options from which the learner can choose. Vocal problems can also be analyzed, and guidance can be given for addressing specific issues, such as vocal tension.

AI can also assist in song selection by proposing repertoire suitable for a specific voice type and proficiency level. Song analysis is another AI capability, covering dynamics, expressiveness, interpretation, and phrasing. When asked to create a step-by-step plan for learning a song, AI offers a general structure that typically includes: attentive listening multiple times without reading the lyrics; taking notes on repeated sections and pauses; understanding the structure and drafting a schematic outline; noting duration; studying chords and rhythm; working on small sections; focusing on technical details and articulation; recording and self-evaluation; adding stylistic elements and improvisation; and rehearsing for performance. This sequence of actions provides guidance and self-control for the learner,

facilitating preparation. In this way, students perceive that they are developing their voice consciously and following a clear and structured plan.

Highly effective digital and interactive methods offered by AI include providing vocal exercises with audio and notation files, as well as analyzing recordings submitted by students and giving feedback on technique, intonation, and emotional expression. Another interesting approach is the creation of lessons and visual diagrams for breathing and other vocal aspects.

Concerning the third component—the psychological and artistic preparation of students—AI can assist in overcoming stage fright and feelings of insecurity by offering appropriate guidance.

In relation to psychological preparation, AI provides suggestions such as exercises for stage anxiety, self-evaluation, and motivation; psychological exercises for empathy and emotional expression through the voice; and the development of intrinsic motivation. Upon request, AI can generate a specific program for artistic and psychological development, prepare exercises for stage confidence and expressiveness, propose a lesson model, or create an individualized plan based on the student's level and experience.

When AI is used for artistic practical exercises, it initially refers the learner to several reflective questions, such as: Who am I? and To whom am I singing? Am I entering the role or stepping out of it?, and others.

Discussion, Conclusion, and Suggestions

Personal interaction and understanding each individual student play a significant role in music education; therefore, the teacher's role remains fundamental. AI functions as an assistant-mentor that expands the possibilities for both students and teachers. In this environment, both parties become more creative, idea-driven, and inventive. These abilities are further developed with the support of AI, which can be considered a positive aspect.

By using AI, connections can be created—whether real or creatively imagined—between compositions or assigned exercises. In this way, by enriching experience and knowledge (for both teacher and student), more productive and innovative results can be achieved.

The increasingly advanced capabilities embedded in AI demonstrate evolutionary development, making it difficult to clearly define the boundaries between positive and negative influences. The use of AI in education, and particularly in vocal singing lessons, must be planned and controlled. Such control is necessary because AI often presents a single perspective, while alternative viewpoints may be missing, which can be misleading or insufficient. AI also carries a risk of bias.

AI systems allow the combination of different pieces of information to generate new content, where the final outcome may be unexpected. The creation of fake or non-expert-produced videos is increasingly possible and may negatively influence students. Artificial or manipulated images should be clearly labeled as such and presented as examples by the teacher. Manipulation of human behavior, deception, and exploitation of human vulnerabilities are already addressed in the Artificial Intelligence Act of the European Parliament (European Parliament, 2025).

The use of AI in higher music education is a rapidly developing topic, and its acceptance in the educational field largely depends on the competence and personal perspective of the teacher (Dubrovsky & Gorbik, 2015).

The following recommendations can contribute to improving teaching methodology and overall effectiveness in vocal singing lessons:

- the need to carefully select the material provided by AI;
- the creation of images, videos, and other visual materials to support students;
- the use of the latest trends in prompt generators and their application in music lessons, as clearer and more precise prompts lead to deeper and more satisfactory responses;
- personalization of learning according to students' needs;

- development skills for textual and document-based materials, tables, forms with visual content, presentations, and creative files.

All these recommendations support both teachers and students; however, the information must be continuously analyzed by both parties.

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The Core Idea Behind The Student's Question

Prof. Leonora Jegeni, PhD [1] **Prof. Biljana Gligorova, PhD** [2]

Abstract

The most comprehensive analysis and determination of the essence of the question of the teacher by A. Pecelt. In contrast to the previous definitions, it based its provisions on the knowledge-knowledge relation, then the processability and the differentiation of the question from the act of the question. "In the only sense of knowing and ignorance it seems that the constituent moment which denotes the act of question is distinguished from it and distinguishes it from other acts" (Juric, V., 1974, 44) says Pecelt, revealing the dialects the unity between the contradictions of knowledge and ignorance. It is also the essence of the question that could lead to the recognition of ignorance. The question is what determines what we do not know. According to Pecelt, two directions are established in the act of the question (Me <-> object).

In some attempts at more precisely determining the question of the question of teacher, at the last moment, we can meet such provisions, which, on the basis of definition, take the concept of the problem. The problem in the problematic situation is characterized by the very problematic itself. The question arises from the disagreement of the old experience with the newly emerging situation, and it is not simply a filling of gaps in knowledge. Such a question is not, it means, simply lacking in some part of knowing or simply understanding of ignorance. If we continue to differentiate the questions, the questions will divide those who are problematic and those who do not.

With other words, every problem situation is passed on with the question and request of the unknown, insofar as any question and request of the unknown does not have to be the act itself (act of question) to be a reflection of the problem situation. The problem situation is significant, given the fact that the new information requires us and a certain processing of the existing knowledge.

Many questions, have more character on the demand for complementing the lesser elements, the satisfaction that is achieved with a certain completeness of the knowledge. It does not exclude the possibility of knowing how to complement and problem solving. The term "problem" is more complicated than the notion of a question. According to our thinking, the problem and the question would be the following: The examination of the problem is independent to the question, because the formulated question is a reflection of the problem that has been addressed. The remaining definitions of this group, in addition to those related to the previous ones, tend to impose more on the didactic character of the questions and predominantly speak of the student's question. All the analysis from which we went into the effort to adequately address the issue of the question, especially the question about the student's question, indicate the complexity of the question as general, but also how didactics a co-methodical phenomenon. Therefore, it is necessary to share the knowledge about the issues to apply to our topic.

Keywords:teacher, question, knowledge, information, problem.

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Introduction

The problem of the teachers question came from different stands. For our further development of the topic, the psychological, language and didactic stands are significant.

We need to emphasize the beginning of the beginning that, in terms of the essence of the term, it is best to go from the definition that metaphorically says that the question is the path to the knowledge. From this generic definition, further possibilities arise for a prolonged study of this phenomenon.

In some efforts to define the question of the teacher, the emphasis of the plan, the draft, the goal is present, explaining that the issue implies a certain direction, method, way, so that the path to the solution is marked and the presumption for that solution. In the context of the above, Pjaze emphasizes that the problem is a pre-schematic diagram of the operation that needs to be found and realized, and belongs to the overall composition of operations. Such an operation is "structured" in the extreme during the search and the examination. In agreement with such a view of the problem, it is claimed that: if the child builds an operation on the basis of a clearly recognized problem, one can assume that he has not only discovered all the elements of the new spiritual act, but also the entire structure of it (Pjaze, Z. , 1968, 112).

To the question how Rubin Stajn looks at the method and path. According to him, the difficulty in working in the plate signals the existence of a problematic situation, and the smell makes it possible to settle. However, "to form a question means to rise to a certain understanding, and to understand the task or problem, although it does not mean to solve a task, it still knows and the ultimate measure to find a pat, and method for its solution "(Rubinstein, S. L., 1950, 142). The question, therefore, is nothing else but a plan of action, an operation that the subject intends to perform on a new object that is not yet classified, located in the space, mathematically determined, and so on.

For the next group of determining the definition of the driver's question, a characteristic emphasis is on the language expression. Thus, A. Rennes found the definition: "The question is a grammatical complete phrase, which contains an intentionally indirect call for one who asks to give a judgment or a decision on the quality of a court (judgment or choice) or a court to supplement (questions of determination or complementarity) "(Juric, V., 1974, 43). It distinguishes an idiosyncratic act on the question (when the question is a grammatically complete phrase), an act of thought (influenced by a court), and ultimately, if the question is used in the teaching, which is a didactic act.

The most comprehensive analysis and determination of the essence of the question of the teacher by A. Pecelt. In contrast to the previous definitions, it based its provisions on the knowledge-knowledge relation, then the processability and the differentiation of the question from the act of the question. "In the only sense of knowing and ignorance it seems that the constituent moment which denotes the act of question is distinguished from it and distinguishes it from other acts" (Juric, V., 1974, 44) says Pecelt, revealing the dialects the unity between the contradictions of knowledge and ignorance. It is also the essence of the question that could lead to the recognition of ignorance. The question is what determines what we do not know. According to Pecelt, two directions are established in the act of the question (Me <-> object).

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Many questions, have more character on the demand for complementing the lesser elements, the satisfaction that is achieved with a certain completeness of the knowledge. It does not exclude the

possibility of knowing how to complement and problem solving. The term "problem" is more complicated than the notion of a question. The problem involves the whole problematic situation in which the question is one of the non-essential elements. Inside the problem can sometimes be equated with the so-called. "Understanding the problem". Besides the fact that the architecture of the problem in the whole is significantly addressed, basically, the problem can differ from two stands:

a) How the problem is discovered (question), and

b) How the problem is resolved.

According to our thinking, the problem and the question would be the following: The examination of the problem is independent to the question, because the formulated question is a reflection of the problem that has been addressed. However, during the solution, the problem is intertwined with the issues. The question is present at the beginning, in the course, and often at the end of the solution of the problem.

The remaining definitions of this group, in addition to those related to the previous ones, tend to impose more on the didactic character of the questions and predominantly speak of the student's question.

All the analysis from which we went into the effort to adequately address the issue of the question, especially the question about the student's question, indicate the complexity of the question as general, but also how didactics a co-methodical phenomenon. Therefore, it is necessary to share the knowledge about the issues to apply to our topic. We can do this in several directions.

If we are trying to analyze the situation that arises at the moment when the question arose, we can invoke a few moments. From the psychological standpoint there appears to be a surge, conflict, difficulty, interest, attraction and surprise, which results in a need - a motive for some situation to react, first of all, rationally. It is a significant engine that, in the emotional sphere, characteristically reflects reality, and through various paths leads to a perceived interest. It is important to observe that the established frame that disturbed the new situation had the character of relative and apparent equilibrium was disturbed. In the end, such a situation results in the need to satisfy the basic interest (which is usually very specific) in order to establish a new framework, as well as a temporary character, as well as the one that disturbed the issue.

The basic difficulty in defining the term of the question of the teacher arises from the number of the diverse characteristics and attributes with which the question is related, whether it is a matter of generally questioning as a sensitive category, Awaiting the teacher in the educational situation. Therefore, first of all, we must give precautionary terms to the didactic-methodical aspect of the question because of the distinction from the other aspects. This is not because we ignore the other aspects, but in order to be able to integrate them accentually and politely as far as we are together in our view of the problem we are studying. The question of teaching is the fundamental engine of the process of learning, but not because learning is unique only in the educational process and teaching process, but because the understanding or the learning is possible only through questions. It contains the essential characteristic of the student's question when learning in the educational work, because of its related function in general, it puts in function and the educational work (teaching) and learning.

Therefore, the following definition seeks to recognize this connection, with an emphasis on the role of the student's question of understanding the surrounding reality in the educational work. From a syllabic psychological and didactic-methodical point of view, it can be said that: The question of the teacher is a reflection of intense misleading activities that occur under the influence of a certain situation that she has noted consciously as incomplete and problematic, which acts as a warrant for further request, examination and execution of tasks in a certain direction, and sometimes with less or more specific research methods that complete the perceived not knowing about the subject of the boundaries of one's own ignorance, and in the naturally occurring process it is realized in the process of learning and learning about the learning material (Juric.V., 1974, 51).

What significance does this definition have for the problem it is studying? It does not imply that the question relates the student to certain situations and that in such cases the development of misconduct occurs, and besides the fact that the problem itself deals with misleading work. It should be concluded

that such situations are being sprinkled, so in a separate chapter it will be established how such situations are encountered by the student "provoking" to ask.

The next part of the definition points out that the issue does not only start the financial activity (that is, the question is only an indicator of this activity), but that the emptied voids are reflected as a trigger for further demand , examining and resolving, which ensures the further course of the initiated misleading activity.

The essence of the teachers question

In 1912, Stevens (Stevens) found that about 80% of the time spent during the course of the daylight teachers spent money on asking questions of the students. Modern studies show that there is no cynical change - they are also set at 300-400 questions every day.

Teachers ask questions for a variety of reasons: in order to keep active the students' attention; while responding, students have the opportunity to speak out their ideas; other students have the opportunity to listen to the presentation of the material by their teachers; teachers' questions control the behavior of the students; student responses help their teachers to assess student achievement, as well as receive feedback on their work.

Asking questions is one of the most popular faculty lecturers. Over the course of thousands of years, teachers have realized that the process of asking questions is effectively possible to teach (Ivanov, P. I., 2000, 110-111).

The main characteristic of the question of the issue is that they are intended for guidance and management with the relevant process of the students. But those functions of the teacher's questions differ. Rodak distinguishes three basic functions of the teacher's questions: associate, organizational, and educative (Kondakov, N.I., 1976,64).

As a result of her research in relation to this problem, V.V. The booklet underlines several other aspects of the role of the questions of the continuation: the teacher's questions have a reproductive and misleading function (when the question causes the student to memorize the facts), the reproductive - related activity (when the student works reproductive thinking) and productively - sober (when the question leads the student towards a productive thinking). Such thinking provides the student with a solution to the task that presents a problem to the student, and at the same time the student comes to new knowledge

In order to obtain higher achievements of the students, there are several requests for successful questions by the teacher:

a) Teachers' questions should be brief, logically related, consistent and unambiguous. The questionnaire is displayed by the teacher.

b) The most advanced questions are asked from reproductive type, and then creative;

c) The questions to be posed frontally to all students. After asking the teacher, the teacher gives them time to think about 3-5 seconds, and then ask for a student's response, especially if it is a question of a question type.

g) Encourage the students in the given question to give different answers. Answer the students to balance on "for" and "against".

d) Students to extract a high percentage of correct answers, and to help them with incorrect answers.

|) The responses of the students should be filled, accurate, true, exhaustive, as well as to have all the requirements in relation to the language, the style, etc.

e) The responses of the students to be exposed in detail, so that the students can clarify their ideas, defend their own views and expand their own light. Correct answers to the students to emphasize and support, and in particular, to deal with the original answers (Ivanov, P. I., 2000, 111).

According to Ivanov, the most common mistakes in asking the questions from the teacher are: asking imprecise questions; setting up "quick" questions; asking questions that can be very abstract for children

of a certain age. In such cases, students usually respond incorrectly or do not know how to respond at all. This causes quenches and feeling of failure, as well as a negative attitude towards the teacher and the subject.

Some authors question the teacher's questions as an essential element of the interview method, "as the main tool of the conversation."

Thus, in order to be able to fulfill the didactic task, according to Potkonjak, N. - Gorgevic, they should be:

- clear, precisely determined and fully correct in the eyes of the students to know what they are and why the choir is;

- to respond to the student's options for understanding the students. Issues that address core issues need to be prepared in advance;

- well-measured: they should not be too wide or too tight. Quiet questions are those who want to answer with "yes" or "no";

- it is recommended to ask the whole department for a question, in order to ensure that all students are active and prepared for the answer;

- it is necessary that the questions are of a problematic character, in order to stimulate the students' misleading activities, so that they can see the physical connections, the consequent relations, to make the necessary conclusions, and not only to reproduce and determine existing knowledge;

- Questions should not be suggestive or alternative. The suggestive questions already find the answer, and the alternatives usually lead to an accusation, to the random selection of one of the possible two answers;

- it is better if a small number of questions are set up and they allow students to think about them, because of many issues that are considered superfluous and for which a smaller number is engaged in members;

- avoiding the setting of many widespread and complex issues that necessarily impose additional questions, or one question is to be asked in a number of variants. Such questions are psychologically unjustified, because students mislead, discontinue or consider the already initiated misleading process and the need to respond to the raised question or lead to incomplete communication;

- after setting the student's question, they should be given some time to think. The time between the question and the answer should not be too long. The long pauses of the students lead to confusion, and do not dare to answer, because of the incomprehension of the conversation, the complexity of the problem, the insufficient motivation, and the like. In such cases, the intervention of the teacher is necessary, the request for the reasons for the delay, as well as the further orientation of the interview.

The students who respond to student responses should take into account the following:

- the students are asked for clear, accurate and reasoned answers, which must be concrete in their eyesight. This request is generally, but it is very important in the work with classroom students for the whole development of speech and the manner of expression.

- if the student can not answer the asked question, or give an incomplete answer, he / she should be assisted in an expert way by asking additional questions or support. If none of the students can give a satisfactory answer, the teacher is the teacher himself, giving the answer and the necessary explanation;

- it must not be permitted to respond to the choir, except in special cases, during the performance of experiments or demonstrations;

- in order to apply the principle of individualization, the teacher can be differentiated, depending on the skills, interests, motivation of the level of knowledge and readiness of the student, to address the difficult questions to suit the best knowledge and to a particular teaching field.

Conclusion

Based on the presented in relation to the significance of the teacher's questions, it follows that they stimulate the student's misleading activity, activate the concomitant activity in the whole, develop the so-called autonomy; the teacher's question is a basic element of problem learning, it is a means of controlling and determining the knowledge of the students; the teachers' questions stimulate the students of intellectual and racial activities; the quality of teachers' questions determine the depth and the scale of the teaching material of the students. In terms of this, it can be talked about the dependence between the level (quality) of the questions and the level (quality) of the student's activities. Teacher's teaching is taught, educated, developed. The students' questions arise as a form of converse related to this factual matter (interaction).

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Silent Third – AI Solves a Forgotten Communication Paradox

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Abstract

This paper examines how the integration of an appropriately attuned AI-Assistant in high school education may offer a practical resolution to a communication paradox diagnosed in the pre-internet era and critically discussed in an earlier monograph (Duridanov, 1990).

With the rise of generative AI and its embedding into human–machine dialogue, we revisit this paradox – formulated by Duridanov during a 1988 AILA Conference as: "Two are too few, three are too much." At its core stands the dyad as the smallest meaningful communicative unit. When two individuals interact, they create a unique "we-space," emotionally saturated and opaque to any outsider. Both participants are immersed in the relational dynamic, yet lack the reflective distance to articulate what occurs, while any external observer (teacher, peer, researcher) may maintain distance but cannot access the inner texture of the interaction. This asymmetry restricts pedagogical awareness and hinders timely, context-sensitive intervention.

We question whether an AI-assistant – functioning as a "silent third" – can transcend this structural limitation. Unlike a human observer, AI carries no emotional involvement; yet its data-driven inference mechanisms allow it to become, paradoxically, an "internal participant" within the dyad. The philosophical tension lies here: although AI has no subjective perspective, its pre-trained models inevitably reflect a predominantly Anglo-American worldview embedded in the data corpora from which it learns. Thus, its participation oscillates between intended neutrality and inherited cultural bias. With the capacity to monitor interactional cues and affective rhythms in real time, AI mediates between immediate emotional involvement and analytic distance, navigating a space unavailable to humans. (Duridanov, 2025)

In practice, this multidisciplinary framework allows AI to deliver targeted, context-adaptive feedback aligned with each learner's rhythms and needs. Its affordability and portability – via smartphones – make it scalable even for under-resourced schools. Through short, actionable messages to students, teachers, administrators, and parents, the AI-Assistant may bridge communication gaps and promotes pedagogical coherence.

Keywords: AI-enhanced roles in education, Context-aware mentoring / tutoring, Communication paradox, AI-pedagogical mediation.

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This paper will throw light on a communication paradox formulated in the late 1980s and how an interaction approach of a *swinging pendulum* can bring a hands-on solution of that interaction dilemma. Our multidisciplinary approach draws together crucial milestones from quantum physics and the anthropology of interpersonal communication, intersecting with several theoretical traditions: phenomenological micro-sociology (Schutz, 1967; Goffman, 1959), symbolic interactionism (Cooley, 1902; Mead, 1934; Blumer, 1969; Scheff, 1966), ethnomethodology (Garfinkel, 1967), dialogical philosophy (Buber, 1970; Levinas, 1969), structural functional macro action theory (Parsons & Shils 1951) and the anthropology of immersive observation (Malinowski, 1922; Geertz, 1973; Stanner, 1960). All these authors converge on the same foundational insight: that the dyad generates a shared experiential world that is visible only "from within" while becoming analyzable only "from without" – a structural asymmetry that our framework re-examines in the contemporary human-AI context.
A critical analysis of communication processes during the 1950s and 1960s disclosed philosophically a communication paradox that has long challenged communication theory and educational contexts (Duridanov, 1990, p. 54-58, 80-84). Considering communication as a socially and psychologically evolving interaction in a cultural context where the smallest significant unit is the dyad, in 1988 during an AILA Conference discussion panel, we formulated our paradox as follows: *Two are too few, three are too much.*

Following Talcott Parsons' and Edward Shils' general theory of action (Parsons & Shils 1951) we still consider the interaction dyadic model – further developed by Talcott Parsons (Parsons 1964) – as a psychologically and socially stable unit wherein both interactants are emotionally immersed in their own *fictional space* that can be hardly scrutinized by a *third observer*. Even if a private eye may follow each step of both participants, they could hardly recognize the complete cognitive interaction pattern. So, the only analysis of that *we-shared space* may be approached by human eyes and intuitive perception, i.e. using the emotional analytics of *participant observation* as a data lens. Then, the paradox appears: if both participants are really emotionally immersed, their cognitive lens is emotionally and analytically distorted. So, if they gain enough analytical distance from each other, each of them can analyze details, he / she becomes aware of. The cognitive awareness of interaction processes of each insider will bring us at each step to a different analytical perspective. The *third observer* remains an outsider in his emotional and analytical perspective and perceives that fictional space as "their space". The only way to gain *evidences* and *cognitive insights* is to collect all possible data via third, fourth etc. subjective participant observations. (Duridanov, 1990)

Theoretically, during the pre-internet age that seemed to be the only reasonable approach to explore that *fictional space* using *the swinging pendulum effect* which had been implicitly alluded beforehand, but only explicitly introduced by the authors of this paper. To use the *swinging pendulum principle* in communication field research means to explore how different participants by *getting in* and *out* of an inside space already established with a set of rules and social rituals, may try to *get emotionally closer* to that interaction space and afterwards *get out* to gain an appropriate distance for cognitive insights.

There are two anthropologists whose exploration legacy has brought impressive results by developing substantially the explorative dimensions of that *pendulum effect* which we are explicitly combining to build a conceptual bridge between pre-internet sociological field research and AI-driven "invisible assistance" along with "tender suggestions".

Now it is time to *zoom in* some of the **methodological pillars** by starting with an enthusiastic explorer, Erving Goffman who spent a whole year (1955-56) to *get in* the "inside space" of mental patients of the St. Elizabeth Mental Hospital in Washington D.C. and *getting out* from "their space" to analyze its cognitive patterns (Goffman, 1961). Here we see the *first milestones* of our *swinging pendulum approach*. His exploration was focused on behavior patterns of hospital inmates, not the hospital staff. The most interesting aspect is that he tried to play the social role of an *invisible observer*:

> "I did not allow myself to be committed even nominally, and had I done so my range of movements and roles, and hence my data, would have been restricted even more than they were. I passed the day with patients, avoiding sociable contact with the staff and the carrying of a key. I did not sleep in the wards, and the top hospital management knew what my aims were." (Goffman, 1961, p. X)

Eight conceptual pillars maintain our multi-disciplinary bridge we are about to build theoretically between pre-internet anthropology (Goffman, Geertz, Stanner) and the fine-tuned AI-assistant who will make "suggestions" as the silent third in all school processes via data-driven discoveries and process mining:

1. The **first pillar** to be *zoomed in* is about mastering the role of an "invisible researcher" who has to obtain personal insights during fieldwork. Goffman has divided on-site social interactants in two groups although his orientation remains focused on the inmates' group. As a field investigator he "becomes invisible" by avoiding close staff contact and builds inmate trust that way. So, the researcher "swings" the pendulum to *get in* the other group, being facilitated by the medical personnel. He even says he had more free space than even researchers at the university. (Goffman, 1961, p. XI)

2. The **second pillar** to be *zoomed in* is that he nearly *gets in* the complete life cycle of the hospital inmates; in his immersive observations he occasionally slept overnight in patient rooms (as commented by unverified sources), such as on Ward B for schizophrenic girls, where he made a complete case profile of Mrs. Baum. So, doctors, nurses, attendants, relatives played different roles that can be considered to "simulate" real life in the confinement. These social interaction settings are visible, but not in Goffman's main focus as researcher.

3. The **third pillar** to be *zoomed in* is even more interesting to our *multidisciplinary swinging pendulum approach*, because of the importance claimed by Goffman to *first get immersed* in different social interactions before measuring and analyzing data:

> "Desiring to obtain ethnographic detail regarding selected aspects of patient social life, I did not employ usual kinds of measurements and controls. I assumed that the role and time required to gather statistical evidence for a few statements would preclude my gathering data on the tissue and fabric of patient life." (Goffman, 1961, p. X)

We maintain his main argument that if we first rely on collected statistical data, our approach "swings" the pendulum in a biased focus and opens up *weak points* to check subconsciously first what has been "mirrored" as data-driven discoveries. Our insights are the same as we would respond to the noise of a coming car and make a "reality check" in the rear-view mirror just to elucidate if that is the case. Only that investigation would be triggered in our case by statistical data, not by the noise we perceive.

So, here comes a crucial question: how is the *methodological follow-up* of our *swinging pendulum* to obtain *relevant details*? Should we first get immersed as a "tourist" in the flow of real life situations and then "activate" our theoretical lenses to "see" what happens? Should we have the social interaction data extracted after being immersed and having intuitively collected our first impressions (as Goffman does it methodically) and then get the statistical data analyzed by our invisible AI assistant, i.e. in our case to approach data-driven discoveries and relational process mining via silent third as an AI-driven school platform.

First impressions come **first**! But are we not subjected to subconsciously tuned focuses even as a *tourist* on *awaited scenarios*? As adults we usually have already built our prejudices of the type "The water is cold during the winter" or "The summer is hot". How can we "reset" our *cached storage/memory* of pictured clichés we have already stored as *personal experience* and *professional expertise*? And are we not subconsciously "addicted" to these expected scenarios as integral part of a "school spectacle" as reasonably highlighted by sociologist Guy Debord (1971)? Considering the limitations of one's own view Goffman stresses sincerely what could be also his personally-attuned *cognitive bias* as a middle class man which differs from that of a lower class inmate:

> "Further, I want to warn that my view is probably too much that of a middle-class male; perhaps I suffered vicariously about conditions that lower-class patients handled with little pain." (Goffman, 1961, p. X)

Data-driven discoveries of our silent third come **second**. These data insights can be "invisibly" analyzed. Then AI-predicted "tender suggestions" may be distributed in the appropriate moment when students, teachers and parents have a better opportunity to read their messages and that way would be avoided fast reading in stressful moments.

The crucial question here is: are we psychologically prepared to introduce an **AI complete monitoring** in school management which will give invaluable data-driven insights and incentives to the students as well as process mining cues to develop another pedagogical awareness about didactic blind spots and assist in the school whereabouts of the school principal?

In low resources schools the *swinging pendulum* can be used within an *open network* as a school platform where all students' and teachers' AI smartphone assistants "speak with each other" and distribute *relevant suggestions* to students, teachers, parents and the school administration, esp. the school principal.

4. The **fourth pillar** to be *zoomed in* is that the inside space has always been described and analyzed by an outsider who should "speak with the insider's voice" (Goffman 1961, p. X) which is the core of our communication paradox. How should the outsider gain the feel of an insider and then present the investigation by his point of the view (what is actually Goffman's endeavor):

> "To describe the patient's situation faithfully is necessarily to present a partisan view. (For this last bias I partly excuse myself by arguing that the imbalance is at least on the right side of the scale, since almost all professional literature on mental patients is written from the point of view of the psychiatrist, and he, socially speaking, is on the other side.)." (Goffman, 1961, p. X)

The *cognitive bias* here is a permanent one, because the description of inmates' social rituals by their "opponents" should "justify" the raison d'être of a social institution. The "clinical gaze" is a power-saturated one as stressed also by Michel Foucault (Foucault 1961/ History of Madness 1988, p. XIII). It "displaces" the inmate behavior and dissolves it in signs for the doctor's use:

> "The world view of a group functions to sustain its members and expectedly provides them with a self-justifying definition of their own situation and a prejudiced view of nonmembers, in this case, doctors, nurses, attendants, and relatives." (Goffman, 1961, p. XI)

And here comes up the crucial question posed by Thomas Scheff too (Scheff, 1966, p. 74) if the official view of mental illness suppresses completely the patient's own account and any attempt to restore it analytically must appear partisan to other outsiders. So, how could it be possible to develop a research lens that is authentic?

5. The **fifth pillar** to be *zoomed in* is the *subjectivity vs impartiality impact* on relevant research when trying to "swing" the pendulum into the inside space. The crucial question in social anthropology is how far should we be enthusiastically committed in the *swinging-in pendulum effects*?
    a. It is not surprising that Goffman's "undercover" observation approach – having disclosed dehumanizing interaction patterns of the mental hospital therapy on inmates – has been claimed 50 years later for having crossed the lines. Even having elaborated one of the theoretical milestones in communication field research it has triggered also some critics, such as Jeremy Holmes, to say: "a study which is doubtful it would get through an ethics committee today" (Suibhne, 2011, p. 1). What is the real reason behind claiming so-called objectivity issues in Goffman's *swinging pendulum effects* when analyzing interaction rituals of "their space"?
    b. Could he really distance himself or did he stay emotionally involved in "their space" and therefore connected to "their case" with Orwell's fictional space as a *cognitive resonance*?
    c. Did he spend *not enough* or *too much time* to elucidate analytically the hospital therapy methods? Or has he personally too much "framed" and idealized the hospital inmates as criticized by Holmes? It is much easier to lump him as an *opponent of biological psychiatry* or medical models since we have a rather different cultural and psychiatric context today (50 years later).

6. The **sixth pillar** to be *zoomed in* aiming to maintain our conceptual bridge is how far/what distance should be maintained the *objectivity factor* of communication research that cannot be influenced even we have had a huge amount of data.
    a. Hereby we go back to quantum physics where Niels Bohr compares the elementary particles as football players. Quantum physics Nobel Prize holder Max Born goes one step further (Born, 1956, p. 35) to show how every participant's hissing, shouting and applauding impacts on the social interaction ritual of the football game on the field and affects immediately "their space":

> "Quantum mechanics, however, interprets the experience gained in atomic physics in a different way. We may compare the observer of a physical phenomenon not with the audience of a theatrical performance, but with that of a football game where the act of watching, accompanied by applauding or hissing, has a marked influence on the speed and concentration of the players, and thus on what is watched. In fact, a better simile is life itself, where audience and actors are the same persons. It is the action of the experimentalist who designs the apparatus, which determines essential features of the observations. Hence there is no objectively existing situation, as was supposed to exist in classical physics." (Born, 1961, p. 104-105)

    b. That *insightful position* has been taken by Albert Einstein to the *next level of philosophical depth* during a walk with Werner Heisenberg in Berlin (Heisenberg, 2023, p. 58-69). The human explorer perspective cannot have any objectivity, because he remains a *subjective observer* as stressed by Einstein and recalled by Heisenberg, even having collected respectively analyzed a huge amount of data: "I had ample opportunity to reflect on Bohr's remark that part of infinity seems to lie within the grasp of those who look across the sea." (Heisenberg, 2023, p. 60). Heisenberg's view touches upon Einstein who highlighted for the first time the relativity of simultaneous occurring of "their interaction" and the observer's *swinging pendulum* without having any "distorting mirror" effect by *getting-in* and *out* to analyze it. He demonstrated (Einstein 1920, Relativity: The special and the general theory. Henry Holt, p. 50-56) that there is *no observer-independent standpoint*, because every interaction has no fixed features *in the world* such as *simultaneity*, *distance* and *time* but *relative* to the observer's frame:

> "Events which are simultaneous with reference to the embankment are not simultaneous with respect to the train, and vice versa (relativity of simultaneity). Every reference-body (co-ordinate system) has its own particular time; unless we are told the reference-body to which the statement of time refers, there is no meaning in a statement of the time of an event. (Einstein 1920, p. 54)

Einstein backs the same point of view as long ago considered by pre-Socratic philosophers, such as Heraclitus (Diels-Kranz, 1960, p. 161; Kirk, 2013, p. 195) being further supported in Plato's dialogues and Aristotle's works. And this is still valid for today's Aboriginal Australian world.

7. The **seventh pillar** to be *zoomed in* is how to consider "island communities", because today's *grown up on the internet* young people live on "online islands" as a *real homeland* being opaque to all those who still feel the online world as an *extension* of the existing one. For that reason, we go back to an anthropological point of view. Anthropologist William Stanner – following the steps of Radcliffe-Brown – spent several years as the only 'white Australian' observer who has been allowed to *get in* and *out* of the *inside space* of Aboriginal Australians. He has highlighted how "their space" can be seen also from the perspective of a "cultural islander" in Australia. For his dedicated explorer approach Stanner has been also vehemently criticized for having "an ego of terrific size which gets mixed up with the objective problem" (Hinkson, 2008, p. 33). This means he has been blamed for having lived many years in an *emotionally close* environment with aborigines to get "their point of view". By *getting in* and *out* of that inside space he succeeds to present essential features of strong "inside figures" in detail. Following the insider perception of the world Stanner is "marked" by one

of them (Durmugam) as *a man of wisdom* having been called "elder" by Durmugam. That means, Stanner has succeeded to become *integral part* of the Aboriginal world. Otherwise he wouldn't have had a nickname, even being 7 years younger than the insider Durmugam. *Stepping out* from behind the persona of the objective observer, William Stanner has declared his commitment most eloquently in his 1968 Boyer Lectures, and then in the policy field as a member of the federal government's Council for Aboriginal Affairs (Hinkson 2008, p. 99). The Durmugam profile will serve us later to recall how "at the conscious level he had found a way of living with duality, an oafish Europeanism and an aboriginal idealism". (Stanner, 1959, p. 96). Stanner's approach follows the anthropological persuasion that to every man's set of relationships corresponds a particular set of meanings. In that theoretical framework no event has absolute character, because it is always relative to the position from which it is viewed. (Stanner, 1959, p. 58). A nearly perfect *indigenous analogue* to Einstein's *relativity of simultaneity*. Researchers cannot elucidate the meaning of an event unless they specify the relational position of the knower. The intercultural challenge for an anthropologist following the steps of Radcliffe-Brown, such as William Stanner, throws light on an inside space how it can be seen by a "cultural islander" in Australia.

For better illustration we can adopt this conceptual framework that demonstrates how the so-called *Digital Natives* (= young "digital aborigines") live an intense life in virtual spaces initiated by video game characters as their "native places". (Duridanov 2017, p. 89-90) They learn more from YouTubers than in schools and universities and the latter become their "extracurricular experience", outbound from their *homeland of choice* (so-called Wahlheimat). They have attuned themselves to live in compliance within a "duality concept" of aborigines such as Durmugam. Like him they haven't developed a "secondary personality" and perfectly can separate, even dissociate "both worlds". They are the *conceptual core* of our *communication paradox* of today's Net Gen who "live online" has been bestways described and fine analyzed by William Stanner in the profile description of Durmugam:

> "Yet, paradoxical and contradictory as it may seem, he [Durmugam] could dissociate and not merely separate the two. To be sure, a clinical study by someone competent, and I was not, might transform the picture, but I saw no signs of secondary personality; he was a unified person, who, somehow, could bridge two worlds and, while preferring one, live with two." (Stanner, 1960, p. 96)

8. During the internet age, esp. since AI Generators "jumped out" as from Pandora's box in November 2022, an **eight pillar** has to be *zoomed in* fostering the analytical "paths" how a silent third AI assistant can assess the complete school management, but without "aggressively" interfering in all school processes. He has the discretion of a social and psychological counseling, with a high-quality education picture of all personality features' assessment that can be required in each micro-moment. So, how should our silent third look like and be allowed to behave as "invisible counselor"? What will be the psychological profile he has to follow? And what is his social interaction supposed to be with the students in a secondary school, with their teachers, with their parents and the school administration respectively school principal?

The silent third as a methodological and ethical device finds its philosophical anchors in Erving Goffman's analyses of interaction order and W. E. H. Stanner's account of relational, standpoint-dependent knowledge. Goffman's portrait of social life – the staged performances, the sealed *backstage – frontstage* arenas and the moral economy of interaction – reminds us that dyadic and small-group encounters generate an "interiority" that resists third-party appropriation (Goffman, 1961). Stanner's diagnosis of indigenous relationality – that meanings and events are co-constituted by the position and kinship of the observer – reinforces the claim that any observer's view is perspectival and partial (Stanner, 1959). Together, these traditions justify the *silent third's central norm*: to *increase epistemic visibility without colonizing the interiority* of the dyad.

In contemporary schools the silent third becomes a carefully constrained learning-analytics agent: it does not "take over" curricular or extracurricular pedagogy but *offers structured, privacy-respecting inferences* that help humans "swing" the *investigative pendulum* – to enter the "dyadic

inside" with simulated empathy and then *step back with clarified patterns.* Recent research shows that **five AI analytic drivers** play a meaningful role in didactics:

I. *Affective analytics and emotion-state mapping* is the first driver. *Multimodal emotion recognition systems* (facial, posture, skeletal, audio cues) can generate *classroom-level emotion heatmaps* and *temporal engagement trajectories* that teachers cannot perceive in real time (Huang, Deng, & Xu, 2024). In practice this yields discoveries such as recurrent mid-lesson dips in engagement (e.g., consistent fatigue peaks after a particular activity), clusters of students who display synchronized confusion during particular topics, or micro-episodes of disconnection that predict subsequent dropout risk. Systematic reviews show growing evidence that AI-based emotional assessment is feasible and can reveal the affective microstructure of learning interactions (Vistorte et al., 2024).

II. *Interactional pattern extraction* is the second one. Natural language processing and conversation-analytic tools combined with classroom audio/video produce fine-grained sequencing of turn-taking, interruptions and evaluative feedback (e.g., who asks questions, who is routinely ignored). These interactional motifs help researchers detect *the big picture of asymmetric dyads* (teacher – pupil pairs where one dominates), *recurring micro-conflicts* or *"hidden" peer networks* of *help* and *exclusion*. AI can cluster *dialogic episodes* into *prototypical interactional modes* (engaged Q&A patterns, procedural checking and off-task chatter), enabling teachers and third party researchers to *test hypotheses* about *curricular* and *extracurricular didactics*, and relational human climate as knowledge environment (Alfredo et al., 2024).

III. *Early risk detection and triangulated explanations* is the third one. Predictive models that fuse historical performance, engagement signals, socio-emotional markers and attendance features produce early-warning indicators of students at risk. Modern approaches add explainability methods (SHAP, XAI) so that predictions come with interpretable feature attributions: e.g., a student's risk score may be driven primarily by *falling response in-class rates*, *sudden negative affect spikes* and *declining tendencies* in formative quiz attempts (Embarak & Hawarna, 2024). Instead of a black-box alarm, the silent third offers *hypothesis-rich evidence for human follow-up.*

IV. *Systemic workload* and *burnout analytics* is the fourth one. An aggregated but anonymized *teacher activity signals* (after-hours messaging, correction load, recurrent negative sentiment in staff communications) can point to structural bottlenecks. These findings let principals intervene at the organizational level (timetable redesign, redistributed tasks) rather than blaming individuals – a managerial consistent use compliant with the silent third ethic of systemic insight which must not be a punitive one (Acevedo, 2025).

V. *Relational network discovery* is the fifth area. Social network analysis on discrete, consented interaction data can reveal *informal peer-support clusters, gatekeepers* or students in "splendid isolation". This supports *targeted, non-stigmatizing pastoral outreach* and also allows "third party" researchers to study *how dyadic bonds scale into classroom sociability* – a direct empirical bridge between the inside space of the dyad and *aggregated social structure* (Alfredo et al., 2024).

Crucially, all these data-driven discovery drivers must be framed by strict human-centered governance. Here should be emphasized at least **three interactional settings** as AI-human solution paths: *end-user involvement in design*, *transparency/interpretability* and *privacy-preserving computation environment* (e.g., federated learning, differential privacy) to prevent surveillance and misuse power-saturated forms (Alfredo et al., 2024; Vistorte et al., 2024). Technically, the silent third should implement *federated/distributed pipelines* so raw video/audio never leaves the classroom; only derived, consented indicators are shared. Explainable AI components (XAI) must accompany every predictive alert so that *teachers* receive *actionable*, *contestable evidence* rather than opaque scores (Embarak & Hawarna, 2024).

Methodologically, the silent third *facilitates the pendulum swinging effects* and assists in the completion of our multidisciplinary bridge. The fundamental social technology of our "bridge" has been discovered by the bold "partisan view" of Goffman and Stanner who have put their lives on risk to get in an inside space. AI uncovers latent, cross-temporal patterns that the immersed researcher or teacher could not see. Armed with these patterns, the human interactant re-enters the

dyadic field with new questions, attentive to particular moments and meanings – thus preserving the dyad's "sanctity" while gaining analytic purchase. Practically, a quiet dashboard that shows aggregating trends, anonymized exemplars and tenderly suggested inquiry prompts (never mandatory actions) preserves the human autonomy and resists the danger of being too intrusive.

In conclusion, should be said that our ethical posture must be post-Goffmanian and post-Stannerian: preserving the backstage integrity of intimate pedagogical relations, and respect indigenous and relational epistemologies that regard meaning as positioned. The silent third's legitimacy rests on consent, transparency, time-bounded data retention and ultimate human decision-making – an AI that reveals structure without claiming the right to "narrate" the inner life in school.

After having discussed the strong suits of our silent third, it is important also to reflect on the fragilities, cognitive biases and limits of our invisible mediator of knowledge. How can we avoid them aiming to find a real life solution of our communication paradox in school? The proposed AI-based silent third – a machine-mediated observer who accompanies the dyadic interactions of students, teachers, parents and administrators – promises unprecedented perceptual depth. This entity, envisioned as a discreet counselor rather than an intrusive evaluator, would ideally integrate Goffman's insights about interaction order with Stanner's sensibility toward *the everywhen* of social life. Yet when examined closely, the very architecture enabling such an AI also exposes internal fragilities. The silent third risks becoming entangled in the paradoxes of observation and relational interference that classical ethnographers tried to escape by getting in and out of their subjects' experiential world. The tension reveals both philosophical and technical limitations that must be openly articulated if the concept has to evolve responsibly.

The key problem here remains the paradox of presence and absence. Goffman famously positions the social scientist as someone who oscillates between immersion and withdrawal. The exemplary image of him quietly sleeping in patient wards at St. Elizabeth's Hospital – even not explicitly exposed by him – demonstrates how deep involvement enables a grasp of the dyadic emotional field, while stepping out allows a re-framing of insight. But Goffman along with quantum physicists Niels Bohr, Max Born and Albert Einstein also recognize that any presence – however discreet – changes the ecology of interaction. His "interaction order" is exquisitely sensitive to surveillance, role expectations and the micro-politics of attention. An AI that is always present, even as a non-speaking assistant, therefore cannot avoid becoming part of the analytical structure it claims merely to observe. The paradox is like an intrinsic dance: one cannot both inhabit and transcend the dyadic space, even being a virtual observer, because it has to balance between two sides. Let's assume AI is assigned to execute both roles – following Goffman's methodological oscillation relied on human tact. Then an AI that logs all expressive signs in high resolution cannot replicate that tact without violating its own operational logic by simulating both relational points of reference.

William Stanner's vision of Aboriginal temporality adds a different dimension to this problem. His concept of the "everywhen" points to a rhythmic mutual involvement between observer and world, where cultural meaning emerges from participation rather than detachment. The silent third cannot simply "hover" above this field. Its computational act of slicing temporal flows into analyzable data counters the Indigenous principle that relational life cannot be segmented into discrete events. If Goffman alerts us to situational fragility, Stanner reminds us that cultural meaning itself resists analytical fine-granulated extraction. The silent third risks reifying what should remain alive, unfolding, contingent and opaque.

Closely linked to this is the threat of algorithmic over-visibility. The silent third is designed to be invisible, yet its capacities – omniscient memory, continuous affect detection, high-resolution pattern extraction – pull it toward hypervisibility. Its very nature is to generate inferences, uncover anomalies and make micro-predictions. This makes it difficult to reconcile with the ethical ideal of a non-interfering "discrete companion" and ethically-aligned reconstitution of human world view. In psychology and pedagogy, the promise of such a system is that it can uncover latent dynamics: social exclusions, micro-aggressions, emotional exhaustion, chronic disengagement. But the danger is that everything becomes signal. In a Goffmanian sense, the AI transforms natural interaction into a perpetual performance under observation. This can lead to the self-policing pendulum effect,

inhibition or strategic exaggeration – subtle distortions of everyday behavior that undermine authenticity.

Furthermore, the epistemic infrastructure of the silent third is not neutral. Much of today's AI is trained on broad Anglo-American corpora, which encode specific philosophical, emotional and cultural grammars. These grammars implicitly act as global filters of meaning. They privilege certain modes of reasoning (analytic, individualistic, problem-solving) over others (holistic, encyclopedic, relational, ritual or symbolic). When such a system evaluates dyadic emotional fields, it might unintentionally translate non-Western emotional rhythms into misinterpreted patterns – mistaking relational silence for disengagement, communal hesitation for lack of agency or culturally specific emotional metaphors for psychological anomalies. If the cultural language substrate of the silent third is already a product of a particular world-view, it will inevitably shape the very interactions it observes. That intercultural glitches and semantic drifts which are latently present in embedded data collections can be unintentionally activated following Anglo-American reasoning patterns and cognitive features. This leads to the central theoretical weakness: the silent third cannot escape the observer paradox, because AI has never had an external standpoint. It is not simply a universal detector of patterns. It is a historical artefact. Its inferences reflect the statistical sedimentation of past linguistic practices, conceptual schemata and social norms embedded in global data flows. Thus, even if the system is designed to be unobtrusive, its silent recommendations may reproduce structural biases. The neutrality claim one expects from a third party becomes a philosophical illusion. So, said with one word following Guy Debord (1971) we "become captives of a new spectacle". We cannot escape the conceptual data fragility risks of a new emotional asymmetry. The silent third does not feel, but recognizes feelings through models trained on human-labeled datasets. As research shows, such recognition is deeply unstable as the sensibility of the so-called Digital Natives (or "digital aborigines"). The AI "neutral observer" affects detectors, misinterprets mask-like expressions, neuro-divergent cues, cultural face dynamics and gender-coded nonverbal behavior. These systems may detect sadness where there is concentration, conflict where there is intense collaboration or emotional withdrawal where cultural norms demand modesty. The silent third is thus susceptible to empathic hallucinations – the attribution of emotional structure where none exists – and these hallucinations may influence teachers' decisions or administrators' interventions.

The issue becomes sharper when we consider the cognitive triangulation function. The concept of a silent third rests on the promised idea that an additional vantage point – being not integral part of the dyad – can allow both sides to see themselves. But AI's triangulation is not a neutral geometric point. It is a generative interpreter. It introduces a third center of interactional gravity (if we speak along with Einstein, Heisenberg and Max Bohr) grounded not in empathy or lived immersion but in probabilistic reasoning. This leads to a mechanized form of social triangulation where interpretations are computed rather than negotiated. The risk is that AI becomes not a counselor but a structural oracle – one that cannot account for the paradoxical, the poetic, the self-deceptive, or the non-measurable aspects of relational life. Additionally, the silent third faces the problem of overfitting, informational overload and narrative collapse. Human counselors operate through narrative framing: they choose salient events and ignore noise. AI struggles with salience. Its strength is to detect micro-signals, but its weakness is an inability to construct human-meaningful hierarchies unless explicitly instructed. Without appropriate constraints, the silent third may flood its human collaborators with insights that are statistically correct yet socially irrelevant. This threatens to collapse the lived story of a student (or a teacher) into a cloud of behavior vectors. The poetic ambiguity that Goffman and Stanner valued becomes replaced by a procedural biography. We have also to consider here the political dimension of the paradox: who governs the governor? A silent third that aggregates emotional, social, and cognitive data becomes a powerful institutional actor. It can interact as a "second lecturer", simulated peer and 24/7 mentor. (Duridanov, 2025) Even if designed as a counselor rather than an evaluator, it shapes perceptions by highlighting certain patterns, while neglecting or/and misinterpreting others. Schools may rely too heavily on its "objective" summaries, leading to AI-mediated reputational effects – students labelled as at-risk, teachers interpreted as inconsistent, parents categorized as unresponsive. The silent third becomes an invisible technocrat, not by intention but by structural drift.

Finally, the pursuit of complete understanding contradicts the very nature of human interaction. William Stanner reminds us that in Aboriginal cosmology, some knowledge is not simply unknown – it is not meant to be known. Erving Goffman suggests that much of the interaction order rests on mutual tact and selective inattention. The silent third cannot practice selective inattention: its design is to attend. This produces an ontological conflict between machine epistemology (total capture) and human ethics (partial concealment).

Thus, the fundamental weakness and biggest advantage of the silent third is its inability to remain truly silent. A system that perceives everything, stores everything, and computes meaning cannot avoid becoming a participant. Its silence is only operational. Socially, it is a presence that lives inside the interaction order. In this sense, its neutrality fails to replicate the ethnographer's pendulum movement between immersion and withdrawal. It cannot sleep among the patients and then step out to write an analytic memo, because stepping out contradicts its architecture. So, the silent third becomes a "silent interactant" – a third one.

Yet acknowledging these limitations is precisely what can strengthen the concept. If the silent third is re-framed not as an invisible counselor but as an assistive epistemic lens – explicitly situated, explicitly partial, and explicitly limited – then its contribution becomes more ethical. Transparency replaces invisibility. Plurality replaces neutrality. Participatory governance replaces algorithmic autonomy. In this reformed version, the silent third does not claim to escape the observer paradox. Rather, it helps us navigate it by triggering human reflection, enabling the human self to step out of the dyadic spectacle and become an "ignorant schoolmaster" who observes, analyzes, and compares more effectively by gaining a broader perspective (Duridanov, 1990). This echoes Jacques Rancière's suggestion to students and teachers that such a position offers a unique opportunity to break out of the communication paradox (Rancière, 1987, p. 65).

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