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|Research Article / Araştırma Makalesi|

Enhancing Gifted Students' Mathematical Thinking Skills (An Example of the Waldorf Approach)

Özel Yetenekli Öğrencilerin Matematiksel Düşünme Becerilerinin Geliştirilmesi (Waldorf Yaklaşımı Örneği)

Niymet Demirci[1], Ebru Ergül[2]

Keywords

Mathematical thinking skills

Gifted students

Waldorf educational approach

Abstract

This study investigates the potential of activities structured around the Waldorf educational approach's emphasis on play, art, nature, and practical implementation to enhance the mathematical thinking skills of gifted students. It was conducted within a qualitative action research design over a twelve-week period with four gifted fourth-grade students enrolled in a formal educational institution, the Science and Art Center. The process began with initial activities and interviews, followed by the development and implementation of four action plans based on play, art, nature, and practical implementation, designed by the researchers with expert guidance. Data were collected through a mathematical thinking test, semi-structured interviews, and field notes recorded by one of the researchers, and were analyzed through content analysis. The findings revealed significant progress in students' specializing, generalizing, and conjecturing skills. However, compared with other dimensions of mathematical thinking, improvement in justifying and convincing skills remained relatively limited. The study is significant in addressing the limited body of research on the role of the Waldorf approach in fostering the mathematical thinking of gifted students. The findings indicate that art, nature-, and play-based pedagogy can make a meaningful contribution to the development of several dimensions of mathematical thinking, while also revealing the need for more explicit instructional support in the areas of justification and convincing. In this respect, the study offers both theoretical and practical implications for teachers and researchers concerning the use of alternative pedagogical approaches in mathematics education.

Anahtar Sözcükler

Matematiksel düşünme becerileri

Üstün yetenekli öğrenciler

Waldorf eğitim yaklaşımı

Öz

Bu çalışma, Waldorf eğitim yaklaşımının öğrenme süreçlerinde öne çıkardığı oyun, sanat, doğa ve pratik uygulama temelli etkinliklerin üstün yetenekli öğrencilerin matematiksel düşünme becerilerini geliştirme potansiyelini incelemeyi amaçlamaktadır. Araştırma, nitel araştırma yaklaşımı çerçevesinde eylem araştırması deseninde yürütülmüştür. Çalışma grubu, dördüncü sınıf düzeyinde öğrenim gören ve aynı zamanda formel bir eğitim kurumu olan Bilim ve Sanat Merkezinde de eğitim gören dört üstün yetenekli öğrenciden oluşmaktadır. Araştırma süreci on iki hafta sürmüş; başlangıç etkinlikleri ve görüşmelerin ardından, uzman görüşü doğrultusunda araştırmacılar tarafından oyun, sanat, doğa ve pratik uygulama kavramlarına dayalı dört eylem planı geliştirilmiş ve uygulanmıştır. Veriler, matematiksel düşünme testi, yarı yapılandırılmış görüşmeler ve araştırmacılardan birine ait saha notları aracılığıyla toplanmış; elde edilen veriler içerik analiziyle çözümlenmiştir. Bulgular, öğrencilerin özelleştirme, genelleme yapma ve varsayım oluşturma becerilerinde belirgin bir gelişim gösterdiğini ortaya koymuştur. Buna karşılık, gerekçelendirme ve ikna etme becerilerindeki gelişimin diğer matematiksel düşünme becerilerine kıyasla daha sınırlı kaldığı belirlenmiştir. Sonuç olarak çalışma, Waldorf yaklaşımına dayalı sanat, doğa, oyun ve deneyim odaklı pedagojik uygulamaların üstün yetenekli öğrencilerin belirli matematiksel düşünme becerilerini desteklemede işlevsel bir potansiyel taşıdığını göstermektedir. Ayrıca bulgular, gerekçelendirme ve ikna etme becerilerinin geliştirilmesi için daha açık yapılandırılmış öğretimsel desteklere ihtiyaç duyulduğunu ortaya koyarak matematik eğitiminde alternatif pedagojik yaklaşımların uygulanabilirliğine ilişkin kuramsal ve pratik çıkarımlar sunmaktadır.

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Introduction

Mathematical thinking is defined by researchers as a rich and multidimensional framework that is divided into various stages and types of knowledge. It includes activities such as reasoning, problem solving, generalizing, and abstracting (Goos & Kaya, 2020; Pedersen, 2023; Villa-Ochoa & Suarez-Tellez, 2021). Some researchers emphasize that generalizing, drawing inferences, proving, and convincing are fundamental elements of mathematical thinking (Breen & O'Shea, 2011). Mason et al. (2010), on the other hand, regard mathematical thinking as a structure comprising specializing, generalizing, conjecturing, and justifying. Specializing refers to working with particular examples to reach general conclusions and is characterized by analyzing examples, identifying and demonstrating them, and discovering patterns (Mason et al., 2010; Stacey, 2006). Generalizing involves starting from specific cases to describe broader phenomena and includes classification, prediction, and expressing relationships in mathematical or verbal forms (Gunadi et al., 2023). Conjecturing covers proposing statements, testing them, forming claims, developing representations, and revising assumptions (Villa-Ochoa & Suarez-Tellez, 2021). The stage of justifying and convincing involves explaining the obtained results to oneself or others in order to persuade them of the solution's correctness (Mason et al., 2010). These processes help individuals evaluate problems from different perspectives, discover alternative solutions, and enhance their decision-making and creative problem-solving abilities (Delima et al., 2021; Gunadi et al., 2023). In this study, the mathematical thinking framework of Mason et al. (2010) -widely used in the relevant literature-has been adopted (Amador, 2022; Barnes, 2021; Celik & Ozdemir, 2020; Faizah et al., 2020; Lorenza et al., 2024). Among these components, problem-solving processes deserve particular attention as they possess a sequential and spiral structure (Burton, 1984; Stacey, 2006). Therefore, problem-solving activities are regarded as an effective method for enhancing mathematical thinking skills. Researchers emphasize that gifted students can maximize their problem-solving potential through authentic and open-ended tasks designed to meet their needs for independence, creativity, and challenge (Bonotto & Santo, 2015; Eysink et al., 2015; VanTassel-Baska, 2013).

Mathematical thinking skills are highly important for gifted students to effectively understand and apply mathematical concepts (Assmus & Fritzlar, 2022). Developing these skills plays a critical role in both their academic success and overall life skills (Kroesbergen & Schoevers, 2017). Research indicates that mathematical thinking enhances analytical abilities and creativity, thereby enabling students to grasp abstract concepts more easily (Assmus, 2018; Lev & Leikin, 2017). These skills also facilitate students' comprehension of complex mathematical ideas (Pitta-Pantazi et al., 2011). As gifted students develop their mathematical thinking skills, they also improve their problem-solving strategies, leading to richer learning experiences (Lim et al., 2023). Therefore, supporting mathematical thinking is crucial not only for academic achievement but also for personal development (Delima et al., 2021). Executive functions-such as updating-are acknowledged in the literature as playing a pivotal role in mathematical thinking and problem-solving processes. Through these cognitive mechanisms, essential aspects of personal development, including analytical reasoning, self-discipline, and academic self-efficacy, are effectively nurtured (Van der Ven et al., 2012). Education systems must implement strategies aimed at fostering these skills and provide supportive learning environments for gifted students.

Education systems aiming to foster mathematical thinking in gifted students have adopted a variety of pedagogical strategies, including inquiry-based learning, problem-based tasks, enrichment programs, and differentiated instruction tailored to students' advanced cognitive profiles (Assmus & Fritzlar, 2022; Leikin, 2011). For instance, the Montessori and Reggio Emilia approaches emphasize student agency and hands-on exploration, while more structured models such as the TAG (Talented and Gifted) programs prioritize accelerated content delivery and abstract reasoning challenges. In contrast, the Waldorf education approach adopts a holistic perspective that integrates imagination, aesthetics, and individual pacing-an orientation that is comparatively less explored in relation to mathematical thinking. Examining the Waldorf approach alongside these more commonly studied frameworks offers the potential to generate novel insights into how alternative pedagogies may contribute to the development of high-level mathematical thinking skills in gifted learners.

The Waldorf education approach, which prioritizes creativity, problem-solving skills, and conceptual understanding, offers a promising framework for meeting the needs of gifted students (Steiner, 1996). Emphasizing holistic comprehension and sensory interaction, Waldorf philosophy stands in marked contrast to rigid educational systems (Aljabreen, 2020; Attfield, 2024; Barth & Wiehl, 2024). Known as "education toward freedom," it encourages individuals to discover their own paths (Carlgren & Klingborg, 1976). Because of this aspect, it is particularly beneficial for gifted students (Goldshmidt, 2017; Huchingson & Huchingson, 1993; Piske & Stoltz, 2021). The curriculum used in Waldorf schools is structured according to different developmental stages (Uhrmacher, 1995) and aims to reveal students' cognitive potential (Nordlund, 2013). By integrating emotional, social, and cognitive dimensions, this holistic approach provides meaningful learning experiences (Goldshmidt, 2017). The flexibility of Waldorf pedagogy reduces potential barriers faced by gifted students, enabling them to succeed academically and personally (Paschen, 2014; Piske & Stoltz, 2021). This approach enhances gifted students' cultural awareness while encouraging them to gain practical and artistic skills and develop a profound respect for nature (Goldshmidt, 2017; Huchingson & Huchingson, 1993). Maker (1982) emphasized that specially designed educational programs foster the abilities of gifted students. The intellectual curiosity and creativity nurtured by the Waldorf philosophy have proven effective in achieving these goals (Huchingson, 1990; Huchingson & Huchingson, 1993). Some researchers also suggest that gifted students may thrive in less structured environments (Assmus & Fritzlar, 2022; DeDonno, 2016; Maker, 1982), indicating that the Waldorf educational philosophy holds significant, lasting potential for gifted students as well (Waldorf World List, 2024).

From its inception, Waldorf educational philosophy has been extensively researched in terms of its theoretical framework, fundamental philosophy, and characteristics (Aljabreen, 2020; Attfield, 2024; Barth & Wiehl, 2024; Berner, 2023; Boyd, 2018; Daskolia & Koukouzeli, 2023; Goldshmidt, 2017; Kaya & Gündüz, 2015; Lutzker, 2024; Masters, 2009; Neumann, 2024; Oberski et al., 2007; Paschen, 2014; Rawson, 2024; Taplin, 2024; Uceda, 2015; Veiga, 2015; Wright, 2013). Some comparative studies have also examined the extent to which national curricula align with the Waldorf curriculum (Bak, 2023; O'Connor & Angus, 2014; Shank, 2016). However, research on how Waldorf philosophy contributes to students' development remains limited (Nicholson, 2000; Van Schie & Vedder, 2023), indicating a noticeable lack of concrete evidence regarding the developmental outcomes of the Waldorf philosophy. In the field of gifted education, studies on Waldorf philosophy also appear to be constrained in scope. Although pilot studies conducted in previous years at public schools hinted at the potential benefits of this approach (Huchingson, 1990; Huchingson & Huchingson, 1991; as cited Huchingson & Huchingson, 1993, p. 402), recent research has not focused on its developmental contributions. As reported by Huchingson (1990) and Huchingson & Huchingson, (1993), activities implemented under a curriculum inspired by Waldorf Principles-applied by teachers providing Waldorf education to fourth- and eighth-grade students-led to superior outcomes in areas such as artistic ability, environmental awareness, public speaking, and creativity among students participating in the Waldorf program, compared to those receiving traditional education. Additionally, Waldorf students displayed higher levels of self-confidence and eagerness to learn than their peers in traditional education. It was also observed that, as the duration of program participation increased, students made notable progress in terms of motivation and creativity. Similarly, Piske and Stoltz (2021) highlighted the significant role Waldorf-based activities play in fostering creativity and social interaction, thereby supporting gifted students' advancement across various domains of knowledge-a finding that confirms the continuing potential impact of Waldorf philosophy in more recent times.

Building on Goldshmidt's (2017) view that Waldorf philosophy can yield effective outcomes in mathematics education, this study aims to develop the mathematical thinking skills of four gifted fourth-grade students attending a Science and Art Center (SAC), whose skills in this area have identifiable aspects open to improvement. These centers are specialized education institutions operating under the Ministry of National Education (MoNE) in Türkiye, established to enhance the potential of primary, secondary, and high school students identified as gifted in general mental ability, visual arts, or music through standardized tests and expert evaluations. In these centers, students participate in a tiered educational framework outside of formal school hours, which includes progressive stages such as orientation, support education, individual talent recognition, special talent development, and project production (MoNE, 2025). Moving beyond the conventional curriculum, this pedagogical process is designed with an interdisciplinary approach, aiming to

foster students' higher-order cognitive skills-including creative thinking, problem-solving, and scientific research techniques-within a workshop-based and project-oriented structure that differs from traditional school environments (Sak, 2024).

During the intervention process, elements emphasized in Waldorf educational practices-such as play, art, nature, and practical learning-were utilized to address the identified developmental needs of the students. The Waldorf approach holds strong potential for gifted students, as it supports creative and holistic thinking skills through art-, nature-, and play-based learning processes. This approach enables students to make sense of mathematical concepts not only at an abstract level but also in aesthetic and experience-based contexts. Thus, higher-order skills such as specializing, generalizing, conjecturing, and justifying can develop in a multifaceted manner. The limited number of applied studies in the existing literature examining the effects of the Waldorf approach on mathematical thinking skills-particularly in the context of gifted students-increases the originality of this research. The contribution of this study to educators is to provide practical examples and strategies for integrating Waldorf pedagogy into mathematics education, offering an alternative perspective for instructional design. For students, it transforms the learning process into a more meaningful, motivating, and creativity-enhancing experience. In terms of the learning environment, it contributes to the construction of mathematical thinking in a more natural and lasting way by creating an interdisciplinary, interactive, and participatory learning atmosphere. Accordingly, the following research question was addressed: In light of the students' experiences, how do Waldorf-based activities foster gifted students' skills in specializing, generalizing, conjecturing, justifying, and convincing?

Method

This study employed the action research design proposed by Kemmis and McTaggart's (2014) to enhance gifted students' mathematical thinking skills. Rather than testing a hypothesis, the goal of action research is to examine specific educational contexts in depth. For this reason, the action research method is highly suitable for investigating the learning processes of a particular group (Patton, 2014). In this research, changes in gifted students' mathematical thinking skills were described by utilizing activities based on the concepts of play, art, nature, and practical implementation, all of which are emphasized in the Waldorf educational approach. Due to the unique cognitive characteristics of gifted students, a consciously selected small sample group (gifted students) was chosen in order to explore their mathematical thinking processes in detail. This small sample provided an opportunity to closely observe the individual reasoning strategies, challenges, and conceptual development of students who are often overlooked in large-scale studies (Robson, 2024). Therefore, the chosen approach aligns with the strengths of qualitative research, which prioritizes rich, context-focused insights over broad generalizations (Creswell & Poth, 2018). The action plan of the study can be seen in Table 1.

Table 1

The Action Plan of the Study

Planning	Implementation and Observation	Reflection
Literature review	Implementation of the "Square Sequence" problem	Exploration of the effects of the implementation
A reassessment of the research problem in light of the literature	Weeks 1 and 2 First implementation: Mathematics Through Play / Multiplication and Area Calculation Game Time: This cycle consisted of four class sessions, each lasting 40 minutes	A joint reflective discussion of the implementation process between the instructor and the researcher
Collaborative planning of the implementation process by the researcher and the instructor	Observation of the implementation and assignment of the "Hat Average" task	Analysis and interpretation of the research data
	Revision of the subsequent action plan based on observations and student evaluations	Reporting of the results
	Weeks 3, 4, 5, and 6	

Planning	Implementation and Observation	Reflection
	Second implementation: Art and Mathematics / Geometric Designs and Perspective Calculations Time: The second cycle consisted of eight class sessions, each lasting 40 minutes Observation of the implementation and assignment of the “Odd Number Pattern” task Revision of the subsequent action plan based on observations and student evaluations Weeks 7, 8, and 9 Third implementation: Mathematics in Nature and the Human Body / Fibonacci Numbers and Patterns Time: The third cycle consisted of six sessions, each lasting 40 minutes Observation of the implementation and assignment of the “Pizza Ratio” task Revision of the subsequent action plan based on observations and student evaluations Weeks 10, 11, and 12 Fourth implementation: Mathematics in Daily Life / Market Shopping and Picnic Budgeting Time: The fourth cycle consisted of six sessions, each lasting 40 minutes Observation of the implementation and assignment of the “Problem-Design Task”	

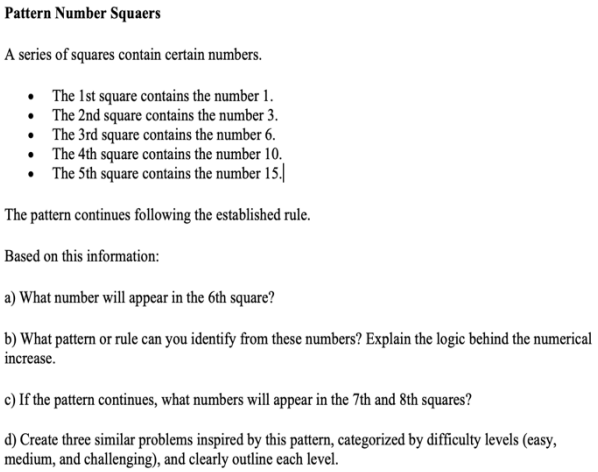
Participants

The participants in this study include the researchers and the students. The first researcher has been working as a teacher for 16 years and has been serving at the SAC since 2021, currently working as a classroom teacher and acting as the practitioner of the research. The study was carried out during the 2024-2025 academic year with four fourth-grade students attending a SAC under the MoNE (SACs are specialized, after-school public educational institutions in Türkiye designed to foster the potential of students identified as gifted in general mental ability, visual arts, or music through standardized assessments.). The study was launched when the first researcher, having observed the need for support in courses designed to enhance creative thinking, problem-solving, and deep learning skills among SAC students, consulted the second researcher for collaboration. The second researcher has 12 years of experience teaching in public schools and has continued mathematics education research for the past four years as a faculty member at a state university. The second researcher collaborated with the practitioner in devising action plans, monitoring the implementation process, addressing shortcomings, and analyzing the data.

The first researcher, holds a doctorate in mathematics education. Based on long-term observations in the courses conducted with gifted students at the SAC for the stated objectives, the researcher identified that the students experienced persistent difficulties in defining and extending patterns, performing calculations related to these patterns, engaging in reasoning, and applying these skills in real-world contexts. To address these challenges and precisely diagnose the problem, the teacher administered the “Square Sequence” problem (Stacey, 2006) to 52 gifted students aged 9 to 10 as a regular classroom activity on a typical school day. The results of this problem were then shared with the second researcher.

Figure 1

Square Sequence Problem



Pattern Number Squaers

A series of squares contain certain numbers.

- The 1st square contains the number 1.
- The 2nd square contains the number 3.
- The 3rd square contains the number 6.
- The 4th square contains the number 10.
- The 5th square contains the number 15.

The pattern continues following the established rule.

Based on this information:

a) What number will appear in the 6th square?

b) What pattern or rule can you identify from these numbers? Explain the logic behind the numerical increase.

c) If the pattern continues, what numbers will appear in the 7th and 8th squares?

d) Create three similar problems inspired by this pattern, categorized by difficulty levels (easy, medium, and challenging), and clearly outline each level.

The students' written and oral responses to the "Square Sequence Problem" were meticulously analyzed by the researchers according to the evaluation criteria presented in Appendix 1. Based on the analysis results, the overall performance levels of the students' mathematical thinking skills are presented in Table 2.

Table 2

Initial Performance Levels in Mathematical Thinking Skills (All Students)

*Performance Level	Number of Students (n)
Weak Performance (WP)	4
Moderate Performance (MP)	2
Good Performance (GP)	16
High Performance (HP)	30
Total	**52**

Note. * Please refer to Appendix 1 for the definitions and examples of performance levels.

According to Table 2, students in the entire class exhibit different levels of mathematical thinking skills. Despite the first researcher, who is a teacher in the SAC class, having previously implemented various engaging activities (e.g., algorithmic coding tasks, robotics design projects, and non-routine problem-solving exercises), some students have still not reached the desired level of mathematical thinking skills. In this study, the number of participants was deliberately limited in accordance with the nature and scope of the action research design. Action research prioritizes in-depth, context-specific investigations over generalizability and is based on iterative processes (Creswell & Guetterman, 2019). Since the intervention process involved providing individualized guidance, conducting interdisciplinary activities, and maintaining one-on-one interactions, working with a small group was pedagogically necessary. Furthermore, the pedagogical principles of the Waldorf approach-which centers on art-, nature-, and play-based learning-are better suited to small-group implementations as they emphasize individualized learning experiences. Increasing the number of participants could have compromised the authenticity of the intervention and the integrity of the instructional design.

Therefore, based on a systematic needs analysis, the study was structured with a limited number of participants to allow for intensive work with students whose mathematical thinking skills were identified as having the greatest potential for development. Accordingly, a total of four students—two girls and two boys—were included in the study based on their own consent and the informed consent of their families. To protect their privacy, personal information has been anonymized and pseudonyms have been used to represent each individual ("Ali," "Zeynep," "Mehmet," and "Elif"). Detailed results of the participants'

mathematical thinking skills and performance levels are presented in Table 3 using these pseudonyms. This classification was determined through a comprehensive analytical rubric that evaluates each skill-specializing, generalizing, conjecturing, justifying, and convincing-against specific behavioral indicators derived from the preliminary assessment tasks. The theoretical and operational framework for defining these levels (Weak, Medium, or Strong) is detailed in Appendix 1. Readers may refer to this appendix for a thorough breakdown of the scoring parameters and performance descriptors used in the categorization process.

Table 3

Initial Performance Levels in Mathematical Thinking Skills (Participating Students)

Student	Mathematical Thinking Skills	Numbers in Squares Problem	Overall Performance Level	Problem-Posing Skills
Ali	Specializing	Could not detect the rules of numerical change within the squares. (WP)	Weak Performance (WP)	Easy: Unable to define the problem. Moderate: Attempted solving with only a few examples. Difficult: Unable to personalize the problem or progress the solution
	Generalizing	Calculated only a few steps but could not derive a general rule. (WP)		
	Conjecturing	Formed a conjecture such as "If the number in one square doubles, how do the others change?" but could not develop it further. (MP)		
	Justifying and Convincing	Did not present any justification for the solution. (WP)		
Zeynep	Specializing	Took certain numbers as examples but failed to recognize the pattern. (WP)	Weak Performance (WP)	Easy: Had difficulty defining the problem. Moderate: Tried solving with only one example. Difficult: Struggled to identify the steps required to solve the problem.
	Generalizing	Did not attempt to create any general formula. (WP)		
	Conjecturing	Did not form a conjecture. (WP)		
	Justifying and Convincing	Did not offer explanations regarding the solution. (WP)		
Mehmet	Specializing	Partially noticed the pattern but could not fully explain its rules. (MP)	Moderate Performance (MP)	Easy: Tried to solve the problem by giving basic examples. Moderate: Explored some solution approaches but lacked clarity in explanation. Difficult: Unable to analyze the problem in depth.
	Generalizing	Made small-scale generalizations but left them incomplete. (MP)		
	Conjecturing	Formed a conjecture such as "If the numbers in the squares increase by three each time, how would the result change?" but could not prove it. (MP)		
	Justifying and Convincing	Provided no logical explanations for his solution. (MP)		
Elif	Specializing	Did not recognize the pattern in the squares. (WP)	Weak Performance (WP)	Easy: Had difficulty defining the problem. Moderate: Attempted simple examples. Difficult: Could not proceed step by step to solve the problem.
	Generalizing	Unable to formulate a different rule. (WP)		
	Conjecturing	Did not make any conjectures. (WP)		
	Justifying and Convincing	Did not provide any explanation for her solution. (WP)		

According to Table 3, three out of four volunteer students exhibit weak mathematical thinking skills, while one demonstrates a moderate level. However, almost all four students showed weak performance in specializing, generalizing, conjecturing, and justifying and convincing skills. This needs analysis indicates that the participant group faces significant challenges in applying mathematical thinking skills during problem-solving activities. This finding suggests that these students require support and interventions to further develop their mathematical thinking skills.

Data Collection Tools

Mathematical Thinking Test

In this study, the assessment instrument developed by Cai (2003) was used to evaluate students' mathematical thinking processes (see Appendix 2). The instrument consists of four mathematical problems; three of these are open-ended tasks designed to assess mathematical thinking and problem-solving abilities, while the fourth evaluates problem-posing skills. The relevant instrument was presented in a published source and did not require additional permission for research use. Validity of the instrument was supported by aligning the problems with curricular standards, which was further confirmed through expert reviews and pilot testing. All items were translated into Turkish by language experts, and content validity was ensured through the evaluations of three experts in the field of mathematics education. Subsequently, a pilot study was conducted with 150 fourth-grade students across three primary schools. The reliability of the Turkish version was confirmed with a KR-21 value of 0.83, indicating high internal consistency. For the detailed evaluation criteria of the problems, please refer to Appendix 4.

These mathematical tasks were administered as tasks at the end of each cycle. The purpose of assigning these problems after each cycle is to provide qualitative evidence for interpreting the changes in the students' mathematical thinking skills, which result from the Waldorf philosophy-based activities, and to determine the content of the next action plan.

Semi-Structured Interview Form

Semi-structured interviews were conducted to evaluate the changes in students' mathematical thinking skills based on their experiences gained through activities rooted in the Waldorf philosophy. These interviews allowed students to explain their thought processes during the mathematical thinking tasks. Each interview lasted approximately 30 minutes and was audio-recorded. The interview questions were developed in accordance with the research objectives and tailored to the students' cognitive levels (see Appendix 3).

The interview form consists of two main sections: the first section includes an instructional introduction explaining the purpose of the study and confidentiality principles, along with a personal information part for recording the student's age and pseudonym. The second section comprises four open-ended questions focusing on mathematical reasoning.

In terms of language, grammar, and scientific validity, the questions were reviewed by a classroom teacher, a Turkish language teacher, and a mathematics education expert. To test the appropriateness and clarity of the questions, a pilot study was conducted with 13 fourth-grade students from three different schools. The number of questions in the form remained constant at four before and after the pilot application; however, based on the feedback received from the pilot study, the wording of particularly the second and third questions was simplified and revised to ensure better comprehension for fourth-grade students.

Field Notes

Throughout the research process, the practitioner kept field notes to monitor and reflect on the development of the students' mathematical thinking skills. The changes observed during the Waldorf philosophy-based activities were documented as weekly written notes following each activity.

Development and Implementation of Action Plans

In order to create action plans in line with the needs analysis results for the students participating in this study, the Ministry of National Education's mathematics curricula (MoNE, 2018; 2024) and the SAC

implementation plan outcomes were examined. Additionally, the literature on methods effective for developing gifted students' mathematical thinking skills was reviewed. Mathematical thinking can be fostered through various approaches such as Science, Technology, Engineering, Mathematics (STEM) education, problem posing, computational thinking, and the use of digital tools (Dick et al., 2022; Gunadi et al., 2023; Lambert et al., 2018; Tran et al., 2017; Wu & Yang, 2022). However, for a special group like gifted students, activities based on the Waldorf philosophy have been found to provide conducive learning environments.

Considering the characteristics of the target group, four activities were designed specifically around play, nature, art, and practical life implementations—elements emphasized by the Waldorf philosophy. Prior to the main implementation, a pilot study was conducted with 13 fourth-grade students from three different schools to test the feasibility and clarity of the research instruments. These students shared similar demographic characteristics with the target group but were not included in the final data collection. This stage focused on assessing the comprehensibility of the tasks and the duration of the interviews.

Following the pilot study, the activities presented in Table 4 were submitted for professional evaluation to two associate professors of mathematics education-one from within the country and one from abroad-who possess advanced knowledge of the Waldorf educational philosophy. Based on their feedback and the insights gained from the pilot study, minor revisions were made to ensure the content validity of the activities. Specifically, these revisions involved simplifying the instructions in some of the open-ended tasks to better suit the cognitive level of fourth-grade students and refining the selection of natural materials to enhance their tactile qualities. Furthermore, the experts suggested strengthening the connection between mathematical concepts and practical life implementations-such as gardening or craft-based measurements-to ensure the activities more authentically reflected the Waldorf pedagogical framework. Through this synthesis of expert evaluations and pilot findings, the activities were finalized to achieve their most effective form. The activities prepared by the researchers were then carried out within the specified timeframes.

Table 4

Implementations and the Planning Process

Implementation	Date
Implementation of the "Square Sequence" problem	March 18–22, 2024
Completion of the Multiplication and Area Calculation Game and the "Hat Average" task	March 25–April 5, 2024
Completion of Geometric Designs and Perspective Calculations, and the "Odd Number Pattern" task	April 8–May 3, 2024
Completion of Fibonacci Numbers and Patterns, and the "Pizza Ratio" task	May 6–24, 2024
Completion of Market Shopping and Picnic Budgeting, and the "Problem-Posing" task	May 27–June 14, 2024

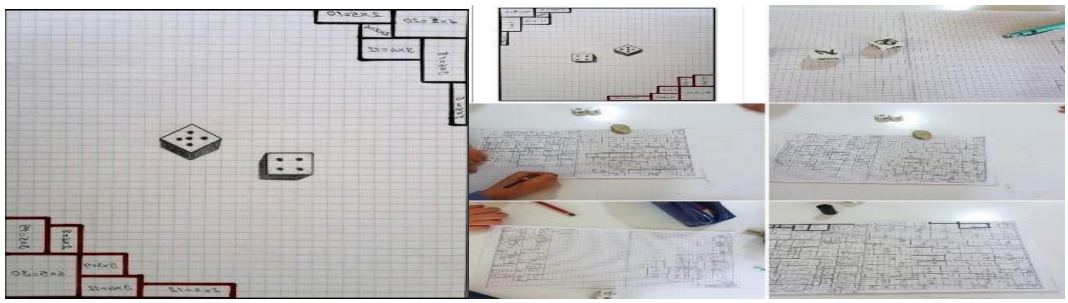
Other details regarding the activities implemented over a 12 week period as part of the action plans, as well as sample images of the implementations, can be presented as follows:

Implementation 1: Mathematics Through Play / Multiplication and Area Calculation Game

The first implementation involves the concept of play, which is one of the fundamental elements of the free and natural learning environments encouraged in the Waldorf philosophy. In this pedagogical approach, play is regarded as an integral part of learning, promoting creativity, critical thinking, and collaboration (Kodsi, 2022; Shank, 2016). The primary objective of this process—during which gifted students calculate the areas of geometric shapes and visualize these areas by drawing patterns on graph paper—is to encourage strategic thinking so that they can utilize their total area in the most efficient manner. Students were expected to aim to exceed the total area of their competitors in an environment where competition and collaboration are balanced.

Figure 2

Multiplication and Area Calculation Game



Following these activities and the completion of the first cycle, the "Hat Average" problem from Cai's (2003) mathematical thinking test was assigned to the students as a task. The findings obtained from the evaluations of the results and students' progress guided the planning of the next cycle.

Implementation 2: Art and Mathematics / Geometric Designs and Perspective Calculations

The second implementation serves as an example of the Waldorf philosophy, which integrates mathematical concepts while emphasizing art and experiential learning (Goldshmidt, 2017; Hallam et al., 2015). The activity aimed to strengthen spatial reasoning, creativity, and the understanding of geometric principles through an artistic and practical approach. It enabled gifted students to develop their abstract thinking, creativity, and problem-solving skills, and encouraged them to design complex patterns using geometric shapes. By calculating perspective angles (Figure 3a), the students not only enhanced their spatial reasoning skills but also deepened their understanding of geometric principles, thereby reinforcing various components of mathematical thinking. Furthermore, the students learned that calculating perspective angles can add depth and dimension to shapes in artistic designs (Figure 3b).

Figure 3a

Art and Mathematics Works Created by Students

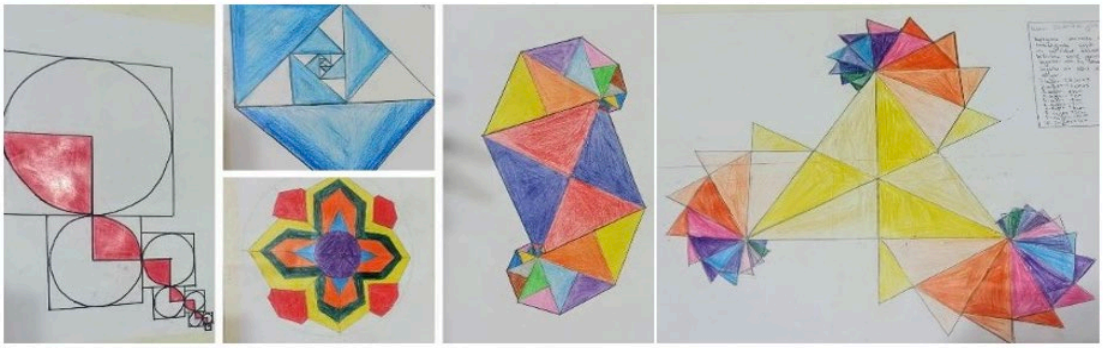
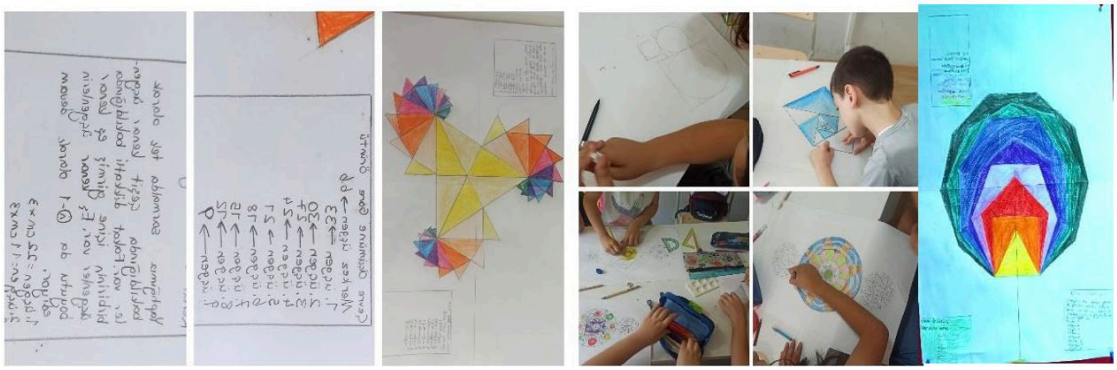


Figure 3b

Mathematical Calculations Related to Students' Artistic Works



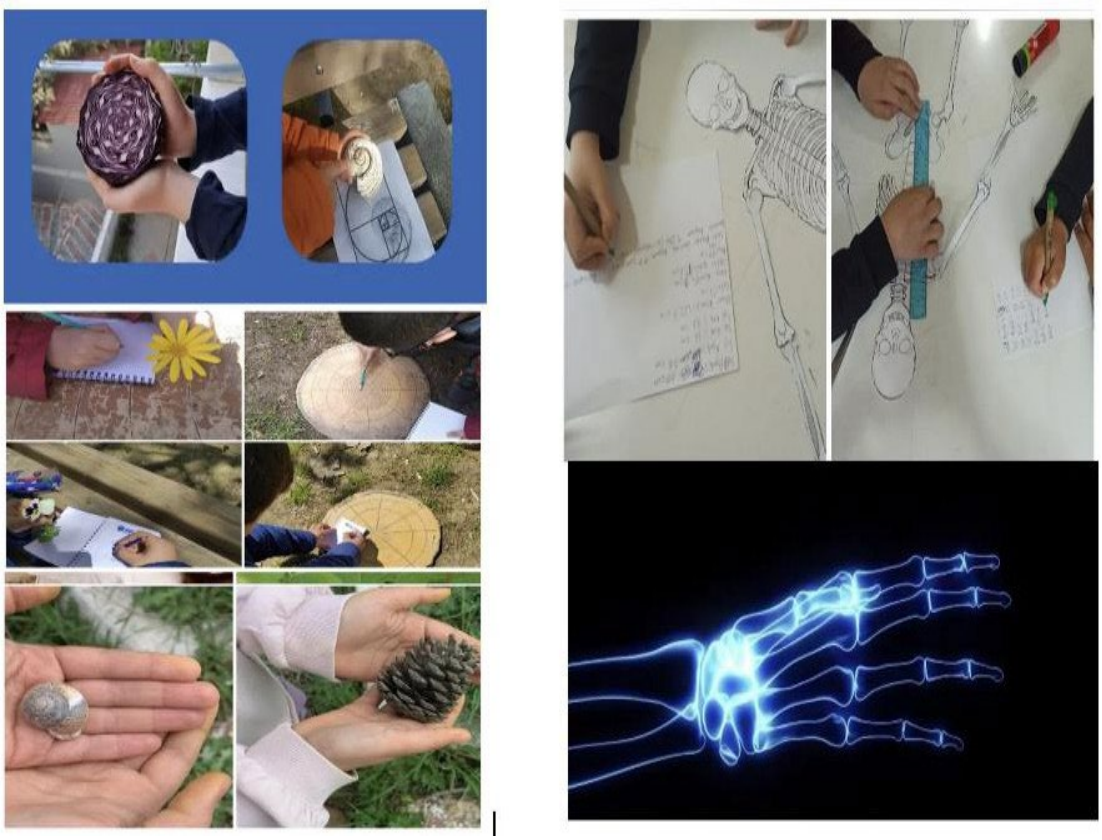
At the end of this cycle, the “Odd Number Pattern” problem from Cai’s (2003) mathematical thinking test was assigned as a task, and the students’ solutions were collected for analysis. The findings obtained from the evaluations of the results and students’ progress guided the planning of the next cycle.

Implementation 3: Mathematics in Nature and the Human Body / Fibonacci Numbers and Patterns

The third implementation was developed based on the emphasis in Waldorf pedagogy (Steiner, 1996; Taplin, 2024) on the holistic relationship that a child establishes with nature and their body. This activity combines the principle of integration with nature and mathematical exploration by focusing on examining the Fibonacci sequence in nature. Gifted students investigated Fibonacci patterns found in various natural objects such as flower petals, tree rings, and snail shells, as well as the golden ratio in the human skeleton. These activities aimed not only to enable a deep understanding of mathematical concepts through real-world implementations but also to contribute to the development of analytical thinking skills and to raise awareness of the relationship between mathematics and nature.

Figure 4

Exploring Mathematics in Nature and Patterns in the Human Skeleton



At the end of this cycle, the “Pizza Ratio” problem from Cai’s (2003) Mathematical Thinking Test was assigned to the students as a task, and their solutions were collected for analysis. The findings obtained and the students’ progress were used to develop and implement the next action plan.

Implementation 4: Mathematics in Daily Life / Market Shopping and Picnic Budgeting

The fourth implementation reflects the practical and hands-on learning approach emphasized in Waldorf education (Rawson, 2024). The activities were integrated into everyday life scenarios-such as market shopping and picnic budgeting-to help students better understand the proportional relationships between the whole and its parts. Gifted students created budgets, planned their expenditures, and visualized these data using graphs (Figure 5). These activities fostered the development of students' critical thinking and data interpretation skills by encouraging them to analyze real-life scenarios through mathematical models and visual representations. This approach enabled gifted students to contextualize mathematical concepts, enhance their thinking skills, and effectively evaluate complex situations.

Figure 5

Market Shopping and Budget Calculation for a Picnic

On the fourth day of this cycle, the "Problem Posing" task from Cai's (2003) Mathematical Thinking Test was administered, and the students' solutions along with the problems they created were collected for analysis.

Data Analysis

The data of the study were examined using content analysis. Content analysis is based on the grouping of similar concepts and themes, which are then organized and interpreted in a manner that is understandable to the reader (Yıldırım & Şimşek, 2018). The data from the problem-solving activity conducted for the needs analysis were subjected to content analysis by both researchers according to the protocol presented in Appendix 1. The analysis results were tabulated (Table 2 and Table 3). Based on the analysis, comparisons were made regarding similarities and differences, and the agreement between coders was calculated. To ensure the reliability of the evaluation process, Cohen's Kappa analysis ($\kappa = 0.98$) was performed, indicating a very high level of consensus between the researchers (Cohen, 1960).

To assess the effects of the activities following the implementation of the action plans, the content analysis of the written solutions to the tasks in the "Mathematical Thinking Test" was conducted by the researchers according to the analysis protocol of Mason et al. (2010) (see Appendix 4). This protocol focuses on identifying key processes of mathematical thinking, specifically specializing, generalizing, conjecturing, and convincing. By utilizing this framework, the researchers were able to categorize the students' cognitive transitions and the depth of their reasoning during the tasks. The analysis results were presented in a table (Table 5). Mutual evaluations were carried out for this analysis, and to ensure consistency, Cohen's Kappa statistic ($\kappa = 0.87$) was calculated, indicating a strong agreement (Cohen, 1960). At this stage, the triangulation method was applied by evaluating the student solutions, their explanations, and the researchers' observations together; in this way, the integration of different data sources was ensured and researcher bias was minimized (Liamputtong, 2019). For this purpose, the audio recordings of the students' oral explanations were transcribed, and the field notes recorded weekly by the researcher were compiled. These qualitative data sources (transcripts and field notes) were not subjected to independent coding; instead, they were utilized as supplementary evidence to verify, contextualize, and provide deeper insight into the students' written solutions. This approach allowed the researchers to cross-check the students' cognitive processes and ensure that their written performance accurately reflected their mathematical reasoning. Consequently, some direct quotes from the participants' oral and written explanations, along with field notes recorded weekly by the researcher, were presented in conjunction with figure examples. These served as evidence of the students' developmental progress in problem-solving and problem-posing performance. Moreover, to further increase the credibility of the data analysis, an experienced associate professor reviewed the findings, and text excerpts supporting the classifications were added to the analysis tables (Appendix 1 and Appendix 4) (Hallgren, 2012).

Ethical Concerns

In action research, the ethical principles to be considered were classified as follows: preparation of ethical documents (ethics statement, permission request document, and official permission document), negotiations (with school administrators/institution officials, participants, and parents), ensuring confidentiality (of information, data, and identity), safeguarding the participants' right to withdraw from the research, commitment to professional and academic conduct, and protection of well-being (McNiff & Whitehead, 2010). In this study, as part of the ethical precautions, the necessary documents-such as ethics statements, permission letters, and informed consent forms-were prepared and approvals were obtained from the relevant institutions. The research was initiated after obtaining ethical approval from the Selçuk University Ethics Committee (decision number: E.722040, date: 13.03.2024). All stakeholders, including school administration, teachers, students, and parents, were thoroughly informed about the study, and voluntary participation forms were signed. Throughout the research process, all observations were systematically recorded, and the data related to student work were labeled with code names to ensure confidentiality. The student data, coded with different names, were presented to an expert to ensure the reliability of the data analysis. Moreover, to maintain transparency, all data were transferred to a digital environment and stored in an encrypted file for a period of time.

Findings

The main research question formulated to achieve the study's primary aim was: “In light of the students' experiences, how do Waldorf activities develop gifted students’ specializing, generalizing, conjecturing, justifying, and convincing skills?”. At the end of the 12 week process conducted within the framework of Waldorf activities, the findings on the development of gifted students’ mathematical thinking skills are presented in Table 5.

Table 5

Developments in the Mathematical Thinking Skills of Gifted Students

Student	Mathematical Thinking Skills	After Implementation 1 (Hat Average Problem Solving Task)	After Implementation 2 (Odd Number Pattern Problem Solving Task)	After Implementation 3 (Pizza Ratio Problem Solving Task)	After Implementation 4 (Problem Posing Task)
Ali	Specializing	WP	GP	HP	HP
	Generalizing	GP	HP	HP	HP
	Conjecturing	GP	HP	HP	HP
	Justifying and Convincing	WP	WP	WP	GP
Zeynep	Specializing	HP	GP	GP	HP
	Generalizing	HP	GP	GP	HP
	Conjecturing	HP	GP	GP	HP
	Justifying and Convincing	WP	WP	WP	GP
Mehmet	Specializing	GP	GP	HP	HP
	Generalizing	GP	GP	HP	HP
	Conjecturing	HP	HP	HP	HP
	Justifying and Convincing	WP	WP	WP	GP
Elif	Specializing	MP	HP	HP	HP

Student	Mathematical Thinking Skills	After Implementation 1 (Hat Average Problem Solving Task)	After Implementation 2 (Odd Number Pattern Problem Solving Task)	After Implementation 3 (Pizza Ratio Problem Solving Task)	After Implementation 4 (Problem Posing Task)
	Generalizing	HP	HP	HP	HP
	Conjecturing	GP	HP	HP	HP
	Justifying and Convincing	WP	WP	WP	GP

Note. WP :Weak Performance, MP :Moderate Performance, GP:Good Performance, HP:Higy Performance

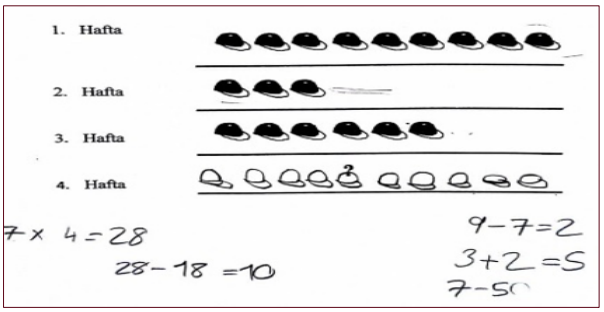
The table 5 provides an overview of the performance levels of four gifted students across four implementations, assessing their skills in specializing, generalizing, conjecturing, and justifying and convincing. Overall, there is a noticeable improvement in most areas over time. Initially, some students exhibited weak performance, particularly in justifying and convincing, but by the final implementation, this category had improved to a good level across all participants. Similarly, the skills of specializing, generalizing, and conjecturing show progressive enhancement from the first to the later tasks. These results suggest that the sequential interventions were effective in fostering the mathematical thinking abilities of the students.

Developments in Specializing Skills

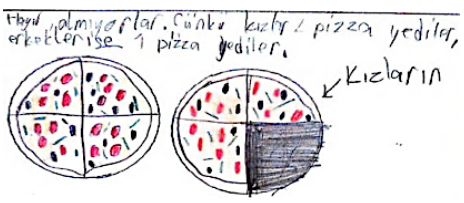
In terms of specializing skills, the most notable development was observed in the increase in students' ability to transfer their concrete experiences with specific examples to mathematical problems in order to reach general conclusions. Ali's performance in the first implementation exemplifies this phenomenon. In solving the first problem (Figure 6), he focused solely on arithmetic operations related to the hat average problem and disregarded the contextual aspects of the problem.

Figure 6

Ali's Problem Solving Performance



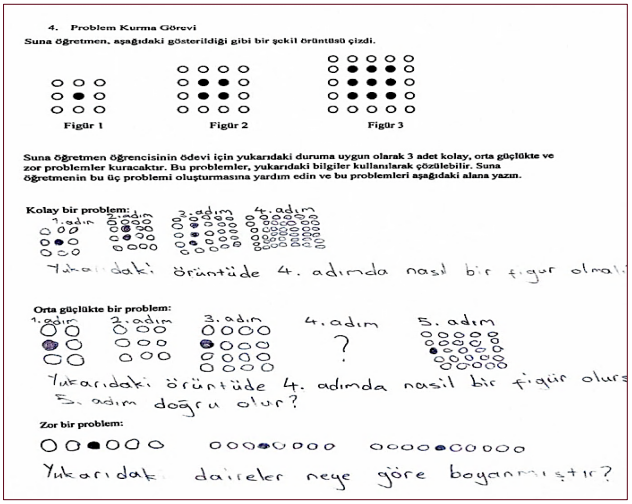
However, following the picnic budgeting activities, he was able to utilize this experience to specialize the problem. His statement-"We created similar tables and graphs in our activities. I will follow a similar approach in this problem" -demonstrates that he was able to apply insights gained from previous experiences to understand the new problem situation. This development was also reflected in his solution to the Pizza Ratio problem.

> To solve this problem, I will try several options. First, let me assume that the amount of pizza received by each girl is equal to the amount received by each boy. Accordingly: "2/7 = 1/3" It turned out that this assumption was incorrect, meaning they are not equal. This implies that in the pizza distribution, the girls have to share the fourth slice among themselves. If we represent this visually, it would appear as follows:
>
> 
>
>
> It is clearly evident that the girls receive less pizza. (Pizza Ratio Task – HP)

Similarly, Zeynep transferred her experience from the budget calculation in the fourth implementation to problem posing by stating, “Actually, when we calculated the budget for the picnic, we were essentially posing a problem. The solution turned out to be easy.” This indicates that the development of her specializing skill influenced her ability to pose problems. At the beginning of the action research process, students were asked to pose a problem in the final step of the “Square Sequence” question. However, Zeynep was not even able to attempt problem posing then. In the problem posing task at the end of the fourth implementation, she demonstrated the performance shown in Figure 7.

Figure 7

Zeynep’s Problem Posing Performance

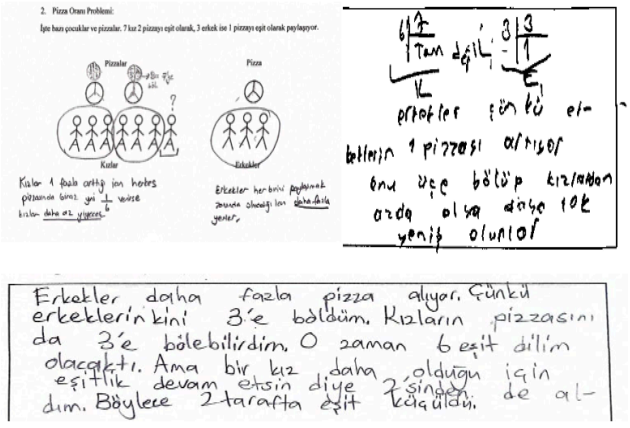


At the end of the third implementation, in the Pizza Ratio problem-solving task, Mehmet was able to develop solutions for the given problem situation by emphasizing the length ratios between the bones in our skeletal structure and the calculation of the golden ratio, thereby exploring different problem scenarios.

> We did an activity about the lengths of our bones and the proportions between them. I can actually solve this by using the example of the golden ratio in our body. There's ratio and proportion involved here. If I look at it this way, I can solve the problem. That way, I would conclude that the girls ate less pizza. (Pizza Ratio Task – HP)

Figure 8

Mehmet’s Problem Solving Performance



These findings support the effectiveness of the mathematics teaching process, underpinned by the Waldorf philosophy, in enhancing students’ specializing skills. Moreover, several statements from the researcher’s notes indicate that the students have made progress in this area. A few examples of these statements are as follows:

> Zeynep's mathematical thinking skills have improved significantly, particularly in integrating art and mathematics. By applying mathematics in artistic contexts and recognizing natural structures, her ability to define problems has been strengthened. Meanwhile, Mehmet's mathematical thinking skills have notably advanced in the context of artistic designs, enabling him to provide quick and creative solutions. Essentially, this demonstrates that his problem comprehension has developed-he is now able to specialize a problem for definition and do so based on correct assumptions.

Developments in Generalizing Skills

The most significant improvement in generalizing skills has been observed in the performance of pattern recognition and formula derivation. Ali's evolution in the odd number pattern problem is particularly remarkable in this regard. The student, who initially struggled to identify the pattern in the square sequence problem, achieved an algebraic generalization such as "y = 2x – 1" in the odd number pattern problem after participating in activities based on the integration of art and mathematics. When asked to explain his solution, he said:

> Let me first check if there is a pattern between the number of bell rings and the guests… Odd numbers cannot be divided by even numbers.
>
> 1.bell = 2 × 1 – 1
>
> 2.bell = 2 × 2 – 1
>
> 3.bell = 2 × 3 – 1
>
> 4.bell = 2 × 4 – 1
>
> It keeps continuing like this. That means it's a formula. We multiply the bell number by 2 and subtract 1. Accordingly, when 99 guests enter, the calculation would be: 2 × 50 − 1 = 99, which means that the bell will ring 50 times. (Odd Number Pattern – HP)

Such explanations indicate that the mathematics teaching process, supported by the Waldorf approach, is effective in developing Ali's generalizing skills. In particular, the statement, "I recalled the patterns in artistic designs… once I noticed that the increment was consistently 2, I established a general rule," highlights the role of interdisciplinary approaches in strengthening mathematical generalization skills.

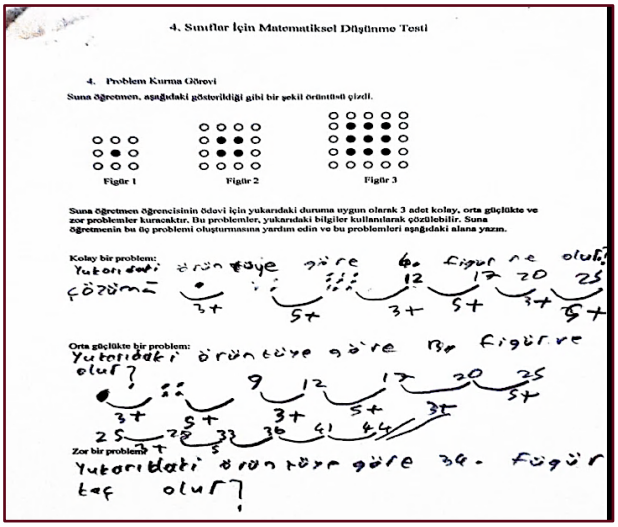
Mehmet's problem posing performance demonstrates the gradual development of his generalization process. Inspired by studies with fractal patterns, Mehmet designed a continuation problem. While constructing his problem, he used expressions such as:

> Just like the Fibonacci spiral in nature. We examined it in plants. The leaves increase by specific numbers. I tried to set up a problem similarly. In art activities, an artist creates new patterns by doubling the number of sides of the previous shape at each step...

Using these ideas, he posed a problem as shown in Figure 9. Notably, before the action research process began, during the Square Sequence task, he had not even attempted to pose a problem. This example illustrates that Mehmet is capable of creatively applying mathematical concepts by generalizing them.

Figure 9

Mehmet's Problem Posing Performance



Some of the researcher's field notes also indicate improvements in generalizing skills. For instance, it was noted that "Elif was able to define broader phenomena from specific cases through the reasoning she demonstrated in multiplication and area calculations."

Developments in Conjecturing Skills

The development of the students' skills in formulating assumptions has become evident in the processes of hypothesizing and testing. In her third implementation task, Zeynep asked, "Do the number of leaves on plants conform to this rule?" regarding the Fibonacci sequence. This question, which involves making assertions, indicates the advancement of her scientific inquiry skills. This situation demonstrates how the natural curiosity of gifted students supports their processes of mathematical discovery.

Mehmet's approach to the hat average problem clearly demonstrates the impact of the multiplication and area calculation game in the first implementation on his mathematical conjecturing abilities. Drawing on the experiences he acquired during the game, Mehmet formed the basic conjecture that calculating an average requires an even distribution while solving the problem. He transformed this conjecture into concrete strategies by stating, "If I know the total number of bell rings (7×4=28), then I can reach the solution… I need to perform subtraction to find the missing one (28–18=10)." His remark, "I tried different approaches at first, but as I learned in the game, I realized that the most logical solution is to calculate the total and then divide equally," demonstrates that he successfully applied the conjecture-testing skills he developed during the game to this mathematical problem. This evidence provides concrete support for the effectiveness of game-based learning environments, as part of the Waldorf-supported mathematics teaching process, in enhancing students' abilities to form strategic conjectures and systematically test them in mathematical problem solving.

Ali's development in the ability to form assumptions is a result of the activities based on the integration of art and mathematics in the second implementation. His approach in the odd number pattern problem clearly demonstrates this progress: his statement, "Every time the bell rings, two more people arrive; it seems to form a pattern," shows that he formed an assumption based on his observations. Using the experiences he acquired during the design of geometric patterns, Ali predicted that the numerical sequence would continue as "1, 3, 5, 7," and he transformed this assumption into a concrete hypothesis by stating that "the bell number is twice the number minus one." This process illustrates how the pattern analysis skills he developed in artistic activities paved the way for creating assumptions about numerical sequences. It is evident that while forming this assumption, Ali referred to the recurring structures in the geometric motifs he had encountered in previous activities.

As noted in the researcher's notes, Ali discovered the relationship in the numerical sequence by recalling the reduction ratio in artistic fractals (n/2), while Elif remarked, "In perspective, all lines converge

at a single point. In this numerical sequence (1, 3, 5, 7...), all increases follow a single rule: two is added each time. Just as lines converge at a single point, these numbers always adhere to the same mathematical rule." This explanation demonstrates that she applied the art concept of "everything has an order" to mathematics as well. These statements provide evidence of how the interdisciplinary approach enriched their ability to form assumptions.

Limitations in the Development of Justifying and Convincing Skills

Throughout the study, the development of students' justifying and convincing skills remained slower and more limited compared to other components of mathematical thinking. For instance, in the solution of the hat average problem during the first implementation, it was observed that students' abilities to justify their answers were quite restricted. Ali reached the correct result by performing the calculation (7×4=28), yet he was unable to explain why he chose that particular mathematical operation. Most students were content with superficial statements such as "Because it needs to be done that way," and they failed to present their solution strategies in a logical manner.

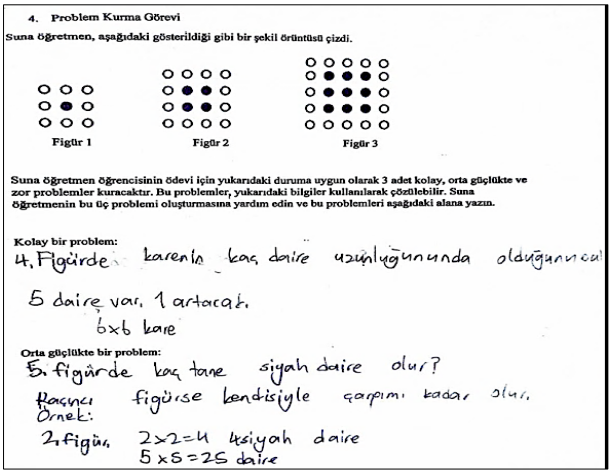
In the odd number pattern problem during the second implementation, students succeeded in identifying the pattern; yet, they struggled to justify the underlying rule. Mehmet remarked that "It goes as 1, 3, 5, 7," but he could not explain why this pattern conforms to the rule "2x – 1." Similarly, although Zeynep correctly extended the pattern, her explanation did not go beyond general statements like "this rule always applies."

In the pizza ratio problem solutions from the third implementation, students performed the calculations correctly, yet they did not present their results in a convincing manner. Elif accurately calculated the pizza distribution between girls and boys but was satisfied with a simple explanation such as "I shared it equally." None of the students provided detailed explanations of their calculation methods or clarified why they selected a particular approach.

Moreover, instances of slow and limited development were also observed. In the fourth implementation, when students were asked to transform a visual pattern containing one black square in Figure 1, four in Figure 2, and nine in Figure 3 into a mathematical problem, they demonstrated more advanced justifying skills compared to previous cycles. Ali, moving beyond the simple proposition that "The number of squares in the nth figure is n^2," formulated a problem that linked the validity of this rule to the increase in side lengths and added an additional inquiry: "In which figure does it become equal to its own product?" (Figure 10).

Figure 10

Ali's Problem Posing Performance



While adapting the pattern to computer game levels, Mehmet developed a problem structure that, by eliminating possible alternative patterns (such as an arithmetic sequence like 2, 5, 8), opened a discussion on why square numbers are more appropriate. As seen in the examples based on problem posing, it is evident that students are now capable of constructing problems that emphasize not only the final result but also the

underlying mathematical processes and logical connections. It can be argued that problem posing tasks have contributed to the development of the, albeit limited, justifying skills of gifted students. In particular, the inclusion of "why" and "how" questions in the problems they formulated reflects this maturation in the depth of their mathematical thinking.

Discussion

Changes in Specializing, Generalizing, and Conjecturing Skills

This action research demonstrated that by harnessing the concepts of play, art, nature, and practical implementations emphasized in the Waldorf educational approach, gifted students' mathematical thinking skills-specifically in specializing, generalizing, and conjecturing-experienced significant development.

The solutions and explanations provided by Ali and Mehmet for the "Pizza Ratio" task (Figures 6 and 8), as well as Zeynep's performance on the "Problem Posing" task (Figure 7), demonstrate that the problem-solving experiences they acquired through real-life implementations (picnic budgeting) and nature-based content enabled them to apply these experiences more effectively to new problem situations. In other words, through these tasks, the students showed improvements in their ability to develop solutions based on different examples—a skill defined as specializing—which in turn reinforces their capacity to understand new problem situations. These findings support Rawson's (2024) conclusion that linking everyday life with academic content through the Waldorf approach provides students with meaningful learning experiences. Moreover, exposure to activities integrated with nature has been shown to promote progress in logical reasoning and strategy formation (Taplin, 2024). Field note analyses further reveal that the students' integration of art and mathematics played a significant role in the development of their specializing skills. This supports the idea that various activities, such as exploring natural patterns and participating in artistic tasks, contribute to the multifaceted problem-solving and problem-posing abilities of gifted students (Piske & Stoltz, 2021). In fact, these types of activities designed to enhance mathematical thinking have increased the students' abilities to analyze specific situations and foster their productivity through personalization, thereby boosting their capacity to analyze and simplify complex problems (Mason et al., 2010).

Ali's progress in solving the "Odd Number Pattern" problem indicates that his generalizing skills have begun to meet the expectations. In this solution, he was able to translate his conjectures into a mathematical expression (equation). Similarly, in Mehmet's problem-posing task, it is evident that the mathematical activities conducted in both nature- and art-based contexts have contributed significantly to the development of his generalizing skills (Figure 9). In other words, Mehmet was able to generate similar problems by generalizing from examples found in the Fibonacci spiral and artistic activities. This demonstrates that the integration of creative and aesthetic teaching practices, such as those in art, can enhance a child's creative potential in mathematics (Huchingson & Huchingson, 1993; Goldshmit, 2017; Taplin, 2024). According to the researcher's field notes, the behavior observed in Zeynep during the multiplication and area calculation game—where she reached broader conclusions through reasoning—can also be interpreted as an improvement in generalizing skills. Indeed, Kodsi (2022) and Shank (2016) report that mathematical games promote multifaceted development in students' mathematical abilities. Therefore, it can be assumed that a portion of the improvements in mathematical thinking skills is attributable to mathematical games.

Zeynep's inquiry at the end of the professional integrating mathematics with nature and the human body through Fibonacci numbers and patterns, Mehmet's hypotheses following the multiplication and area calculation game, and Ali's conjectures after the art and mathematics integration activities—all of which were transformed into hypotheses and further developed—can be regarded as indicators of the growth in their conjecturing skills (Brown & Stillman, 2017; Komatsu et al., 2019; Mason et al., 2010). Moreover, the researcher's field notes indicate that as Ali and Elif tested their hypotheses using various conjectural approaches, they demonstrated an increased capacity to identify relationships among the variables and make more systematic generalizations. All these findings demonstrate that artistic activities foster progress in logical reasoning and strategy formation. Additionally, the success of holistic learning experiences obtained through artistic and creative presentations in subjects such as mathematics, history, or science serves as

further evidence of their effectiveness (Aljabreen, 2020; Lutzker, 2024). Furthermore, although Mehmet initially struggled to understand the problem and establish relationships among data, after the gamified implementation he was able to correctly formulate mathematical relationships in the hat average problem, generalize them, analyze patterns, and create a general rule. This can be cited as evidence of his development in hypothesis formation.

Overall, these findings indicate that the Waldorf philosophy nourishes the unique talents of gifted students and enhances their intrinsic commitment to learning, as reflected in their mathematical thinking skills. The differences observed before and after the intervention confirm the effectiveness of this intervention, as demonstrated in previous studies (Huchingson & Huchingson, 1993; Piske & Stoltz, 2021).

Challenges in the Process of Justifying and Convincing

This study also revealed that there was at least limited progress in the skills of justifying and convincing. However, this development was relatively smaller compared to other mathematical skills. For justification, after the implementations, Ali defended his solution for the hat average problem with a limited perspective by stating, “It needs to be done that way.” In the pizza ratio problem, Elif stated that the distribution was equal but encountered difficulties in explaining the reasoning behind this equality. The challenges that students face in mathematical justification and convincing are not unique to this study; they are frequently highlighted in the literature (Evans et al., 2022; Stylianides et al., 2022). Research shows that even when students are successful in problem solving, they struggle to justify and formally validate their solutions (Mora et al., 2022). This issue is observed among the general student population as well as among gifted students in this study.

There may be several reasons for the limited development observed in the skills of justification and convincing. First, the literature emphasizes that justification and proof are among the most challenging components of mathematical reasoning (Mora et al., 2024; Stylianides et al., 2022). Although gifted students are generally proficient in rapid problem-solving and pattern recognition, they often experience difficulty in systematically validating their reasoning and constructing mathematical arguments (Leikin, 2011). More often than not, they rely on intuitive or experiential approaches to support their results and do not sufficiently focus on formal proof processes.

Second, the pedagogical nature of the Waldorf approach may have influenced these outcomes. Waldorf pedagogy is highly effective in promoting experiential learning, imagination, and holistic thinking; however, it tends to prioritize intuitive understanding over formal logical structures (Goldshmidt, 2017). As a result, students may not frequently encounter activities that require systematic justification or proof. This finding aligns with prior research suggesting that in art- and play-based learning environments, intuitive or aesthetic approaches may be emphasized at the expense of formal proof processes (Komatsu & Jones, 2022; Oberski et al., 2007).

Third, the internal motivation of students to justify their solutions may serve as an important mediating factor. Unless students feel the need for proof or justification to support their solutions, their ability to develop convincing arguments remains weak (Komatsu & Jones, 2022; Lannin, 2005; Mora et al., 2022). Lannin (2005) noted that students actively engage in justification processes only when they feel the need to convince others or to clarify their own thinking. Although the Waldorf-based activities in this study provided opportunities for exploration and expression, they may not have sufficiently created a sense of cognitive conflict or need that would prompt students to engage in justification processes.

Finally, although the students in this study were identified as gifted, their age (9–10 years) may not yet correspond to the cognitive developmental stage required for high-level skills such as abstract reasoning, logical thinking, and structured proof. According to Piaget’s theory of cognitive development, children typically enter the formal operational stage around the age of 11, during which abilities such as hypothesizing, systematic testing, and drawing logical conclusions begin to emerge (Inhelder & Piaget, 1958). Therefore, students in this age group may not yet be cognitively prepared for formal processes such as mathematical justification and proof. Leikin (2011) also emphasized that although gifted students may possess advanced skills in pattern recognition and generating solutions, they may still face difficulties in formal proof and reasoning processes due to their developmental stage. In this context, it can be concluded

that the limited progress observed in the study may be related not only to the pedagogical approach but also to the students' level of cognitive development.

Nevertheless, Ali's written statements and verbal explanations in his problem-posing task (Figure 10), along with Mehmet's incorporation of "why" and "how" questions in the problems he created, indicate that there was some development in their justifying and convincing skills. Therefore, the limited success in fully developing this skill may be attributed to the students' frequent resistance to the processes of justification and convincing. This situation underscores the necessity for instructional approaches that assist students in explaining why and how they apply mathematical concepts. In mathematics education, including for gifted students, expanding proof and validation processses is essential for the advancement of mathematical thinking. This situation suggests that such skills can be improved through targeted instructional strategies such as structured proof-writing activities, opportunities for peer discussion, and step-by-step scaffolding of justification processes (Ball et al., 2003; Kurniawan et al., 2022).

Recommendations

Building on these findings, several pedagogical recommendations can be proposed. First, problem-solving and problem-posing tasks should be designed in ways that require students to justify their solutions and explain their reasoning, thereby addressing the relative weakness observed in justifying and convincing skills. Second, greater emphasis may be placed on integrating mathematics with art in order to make abstract concepts more concrete and to strengthen students' representational and conceptual understanding through drawings, models, and other artistic forms. Third, the connection between mathematics and everyday life may be reinforced through thematic, real-life activities, such as shopping or recipe measurement tasks, particularly when teaching concepts such as ratio and proportion. Finally, professional development opportunities may help equip educators with the pedagogical tools needed to implement Waldorf-inspired and experiential mathematics teaching practices more effectively, thereby fostering gifted students' creativity and mathematical thinking.

Limitations

When interpreting the findings of this study, several limitations must be taken into account. The research employed Mason et al.'s (2010) classification of mathematical thinking skills. While this structured approach is useful, employing different categorizations or theoretical perspectives could yield different results in terms of solutions and verbal expressions, thereby affecting cross-study comparability. The study predominantly focused on pattern recognition and proportional reasoning, and it remains unclear whether similar methods would be equally effective for other mathematical topics. Future research should aim to comprehensively understand the impact of the Waldorf approach by covering a broader range of mathematical concepts. Additionally, the small sample of gifted students limits the generalizability of the findings, and studies involving larger and more diverse samples would enhance the robustness of the results.

Conclusion

Taken together, the findings suggest that the Waldorf philosophy can support the development of gifted students' mathematical potential and enhance their engagement with learning, as reflected in the development of their mathematical thinking skills. The clearest gains were observed in specializing, generalizing, and conjecturing, and the differences identified before and after the intervention indicate the potential effectiveness of the intervention, in line with previous studies (Huchingson & Huchingson, 1993; Piske & Stoltz, 2021).

At the same time, progress in justifying and convincing remained comparatively limited. This pattern suggests that although Waldorf-based, art-, play-, and nature-oriented learning environments are effective in supporting intuitive, creative, and relational forms of mathematical thinking, they may not, by themselves, be sufficient for the full development of formal justification and proof-related competencies.

Accordingly, mathematics education for gifted students may benefit from combining rich experiential learning opportunities with more explicit support for explanation, justification, and proof. Structured proof-writing activities, opportunities for peer discussion, and step-by-step scaffolding of justification processes

may be particularly valuable for extending the gains observed in this study (Ball et al., 2003; Kurniawan et al., 2022).

CRediT authorship contribution statement

N. Demirci: Conceptualization, Methodology, Validation, Formal Analysis, Investigation, Resources, Writing – Original Draft, Writing – Review & Editing; E. Ergül: Conceptualization, Methodology, Validation, Formal Analysis, Writing – Original Draft, Writing – Review & Editing, Supervision.

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Declaration of AI Usage Statement

The authors affirm that no AI tools were employed in the preparation of this article.

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Appendices

Appendix 1: Square Sequence Problem – Mathematical Thinking Performance Assessment Criteria

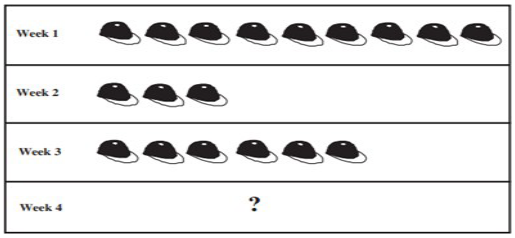
Mathematical Thinking Skills	Weak Performance	Moderate Performance	Good Performance	High Performance
Specializing	Lists the numbers but cannot see the pattern. Example: "1, 3, 6, it goes like that."	Notices the amount of increase. Example: "2, then 3, then 4 is being added."	Calculates all terms correctly. Example: "6th number: 15+6=21."	Performs concrete modeling. Example: "I made a triangle with 21 Lego pieces."
Generalizing	Cannot explain the rule. Example: "I don't know."	States the rule in simple language. Example: "We add one more each time."	Expresses the rule as a formula. Example: "n×(n+1)÷2."	Explains the formula in different ways. Example: "Like half of a rectangle."
Conjecturing	Cannot make a prediction. Example: "?"	Predicts the next term. Example: "The next should be 21."	Predicts more than one term. Example: "7th number 28, 8th number 36."	Discovers the characteristics of the pattern. Example: "Odd-even numbers alternate."
Justifying and Convincing	Cannot explain the solution. Example: "It just came to my mind."	Shows the calculations. Example: "I did 15+6=21."	Solves using more than one method. Example: "Both addition and the formula yielded the same result."	Establishes mathematical reasoning. Example: "Why does the formula work?"
*Problem-Posing	The student only asks for the next step in the pattern. Example: "What number comes after 1, 3, 6?"	The student applies the pattern to a simple real-life situation. Example: "In a market, on Monday 1, on Tuesday 3, on Wednesday 6 customers arrived. How many customers will arrive on Thursday?"	The student integrates the pattern into a complex problem situation. Example: "In a garden, each day one more tree than the number added the previous day is planted. If on day 1, 1 tree is planted, on day 2, 3 trees, on day 3, 6 trees, how many trees will there be in total by the end of day 5?"	The student creates an original and creative scenario by linking the pattern to different mathematical concepts. Example: "A software developer adds as many new features to his implementation each day as the number of features added the previous day. On day 1, 1 feature is added; on day 2, 3 features; on day 3, 6 features. a) How many features will be added on day 7? b) Why is this pattern different from the Fibonacci sequence? c) Explain the advantages of this growth model."

Note. *The problem posing task has been added to the table in Appendix 1 to maintain the integrity of the analysis, and it is a concept separate from the mathematical thinking skills outlined by Mason et al. (2010).

Appendix 2: Mathematical Thinking Test

The Hats Averaging Problem

Alya is selling hats for the Mathematics Club. This Picture shows the number of hats Alya sold during the first three weeks. How many hats must Alya sell in Week 4 so that the average number of hats sold is 7? Show how you found your answers**.**



The Odd Number Pattern Problem

Ahmet is having a party.

- The first time the doorbell rings. 1 guest enters.
- The second time the doorbell. 3 guests enter.
- The third time the doorbell rings. 5 guests. Enter.
- The fourth time the doorbell rings. 7 guests enter.

Keep going in the same way. On the next ring a group enters that has 2 more persons than the group that enteredon the previous ring.

How many guests will enter on the 10th ring?

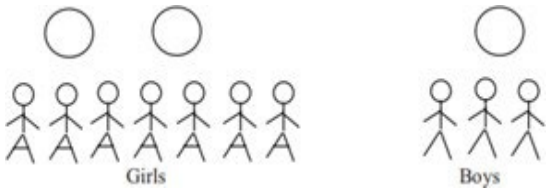
In the space below, write a rule or describe in words how to find the number of guests that entered on one each ring.

99.guests entered on one of the rings. What ring was it? Explain or show how you found yours answers.

The Pizza Ratio Problem

Here are some children and pizzas. 7 girls share 2 pizzas equally and 3 boys share 1 pizza equally.

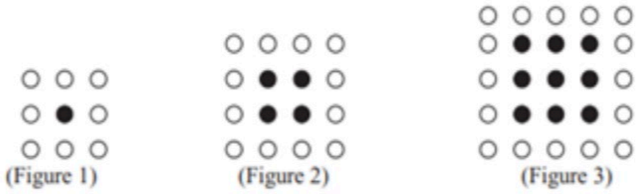
Does each girl the same amount as each boy? (Explain or show how you found your answers.),



If each girl does not get the same amount as each boy, who gets more? (Explain or show how you found your answers.)

The Problem Posing Task

Mr Aylin drew the following figures in a pattern, as shown below.



For this student's homework, he wanted to make up three problems based on the situation: an easy problem, a moderate problem, and a difficult problem. The problems can be solved using the İnformation in the situaiton.

Help Ms Aylin make up three problems and write these problems in the space below.

- The Easy problem:
- The Moderately problem:
- The Difficult problem:

Appendix 3: Semi-Structured Interview Form

Section 1: Instructions and Personal Information

Hello! I would like to chat with you a bit about the math problems we worked on today. The purpose of this interview is to better understand how you think and how you solve problems. This is not a test; it doesn't matter if your answers are 'right' or 'wrong.' What is truly valuable to me is your thought process. Our conversation will last approximately 30 minutes, and I will be audio-recording what you say so that I don't forget any details. These recordings will be used only for research purposes, and your identity will be kept strictly confidential. Thank you for participating!

Student Pseudonym (Rumuz):

Age:

Date:

Section 2: Interview Questions

1. What are your thoughts on the problem? How does it relate to other problems you have encountered previously?
2. Can you elaborate on the method you used to solve the problem? Please discuss the strategies you employed, the solution methods applied, and your thought process during the resolution.
3. Do you have an alternative approach for solving the problem? If so, could you describe your suggested solution? If not, please explain your reasoning.
4. Is the solution you found for the problem valid? How can you assess its correctness?

Appendix 4: Evaluation Criteria for the Mathematical Thinking Performance of Subsequent Implementation Tasks

The Hats Averaging Problem

Mathematical Thinking Skills	Weak Performance	Moderate Performance	Good Performance	High Performance
Specializing	Applies the concept of "average" without truly understanding it. Example: "If Alya sells more hats, the average will increase."	Understands basic concepts but omits important details. Example: "It seems that Alya will sell more."	Correctly understands most aspects of the problem analysis. Example: "A total of 15 hats were sold, and 10 are needed in week 4."	Conducts a comprehensive analysis in every aspect. Example: "18 hats were sold in the first 3 weeks, and 10 are necessary in week 4."
Generalizing	Does not propose a general solution. Example: "Since there are few hats, everyone buys few."	Makes partial generalizations. Example: "There should be an equal distribution, but I mixed up the numbers."	Identifies relationships between examples. Example: "28 divided by 4 equals 7, which gives the average."	Clearly identifies all relationships within the problem. Example: "28 hats over 4 weeks yield the average."
Conjecturing	Cannot form correct hypotheses. Example:	Offers unsubstantiated hypotheses. Example: "It	Forms valid hypotheses supported by analysis.	Forms hypotheses that are well-supported by logical analysis.

Mathematical Thinking Skills	Weak Performance	Moderate Performance	Good Performance	High Performance
	"Maybe everyone buys the same amount."	seems that Alya's sales are increasing."	Example: "10 hats should be sold in week 4."	Example: "The total should be 28."
Justifying and Convincing	Lacks proper verification during the control phase. Example: "I did not check the results."	Follows logical steps but overlooks some errors. Example: "My calculations might not be completely accurate."	Provides a logical approach with verification. Example: "I checked the calculations; it should be 10."	Meticulously verifies all results. Example: "I checked all the calculations."

The Odd Number Pattern Problem

Mathematical Thinking Skills	Weak Performance	Moderate Performance	Good Performance	High Performance
Specializing	Does not understand basic concepts. Example: "Only 1 guest arrived at the first bell; I did not count the others."	Partially recognizes the pattern. Example: "1, then 3, then 5 guests."	Correctly analyzes most aspects. Example: "At the 10th bell, 19 guests arrive."	Conducts a comprehensive analysis. Example: "The number increases by 2 at each bell, so at the 10th bell, 19 guests arrive."
Generalizing	Does not propose a general solution. Example: "I don't know how many people arrived at the other bells."	Partial generalization. Example: "It increases by 2 each time."	Defines the pattern. Example: "It goes as 1, 3, 5, 7…."	Describes all relationships in the problem. Example: "The number of guests at the nth bell equals 2n-1."
Conjecturing	Incorrect hypotheses. Example: "The same number of guests should come every time."	Unsupported hypotheses. Example: "It increases by 2, but I can't keep up as the numbers get bigger."	Forms valid hypotheses supported by analysis. Example: "The number of guests at the nth bell is 2n-1."	Forms hypotheses supported by logical analysis. Example: "For the 100th bell, 199+1=200, 200/2=100."
Justifying and Convincing	Lack of verification. Example: "I did not check the results."	Logical steps but with errors. Example: "The results should be correct."	Logical approach with verification. Example: "I found 99 for the 50th bell, which is correct."	Provides rigorous verification. Example: "I checked all the steps."

The Pizza Ratio Problem

Mathematical Thinking Skills	Weak Performance	Moderate Performance	Good Performance	High Performance
Specializing	Does not understand the basic concept of sharing. Example: "Girls get more pizza because there are many of them."	Recognizes inequality but omits details. Example: "Girls will take more, but I don't know how."	Correctly analyzes most aspects. Example: "Girls take 2/7 and boys 1/3 of the pizza."	Conducts a comprehensive analysis. Example: "Each girl gets 2/7 and each boy 1/3 of the pizza."
Generalizing	Does not propose a general solution. Example: "Because there is little pizza, everyone eats little."	Partial generalizations. Example: "Equal sharing, but what about the last slice?"	Identifies relationships between examples. Example: "Since 2/7 < 1/3, girls get less."	Defines all relationships in the problem. Example: "Since 1/3 > 2/7, boys get more."
Conjecturing	Vague hypotheses. Example: "Maybe everyone takes an equal amount."	Unsubstantiated hypotheses. Example: "It seems that girls eat more."	Valid hypotheses and analysis. Example: "Girls are taking less pizza."	Hypotheses supported by logical analysis. Example: "Because there are more girls, their share is smaller."

Mathematical Thinking Skills	Weak Performance	Moderate Performance	Good Performance	High Performance
Justifying and Convincing	Lack of verification. Example: “I did not check the results.”	Logical steps but with errors. Example: “My calculations might not be completely accurate.”	Logical approach with verification. Example: “I checked the calculations; girls get less.”	Rigorous verification. Example: “I checked all the calculations.”

The Problem Posing Task

Mathematical Thinking Skills	Weak Performance	Moderate Performance	Good Performance	High Performance
Specializing	Does not recognize the basic pattern. Example: “I see the numbers 1, 4, 9, but I couldn’t establish the relationship.”	Partially recognizes the pattern. Example: “The numbers 1, 4, 9 look like square numbers.”	Analyzes the pattern correctly. Example: “It goes as $1^2=1$, $2^2=4$, $3^2=9$.”	Conducts an in-depth analysis. Example: “Square numbers increase geometrically.”
Generalizing	Cannot create a general rule. Example: “The numbers are increasing, but I can’t explain how.”	Makes a simple generalization. Example: “In each figure, the square of the previous number is taken.”	Expresses the mathematical rule. Example: “In the nth figure, there are n^2 squares.”	Expresses the rule in different ways. Example: “$n\times(n+0)=n^2$.”
Conjecturing	Makes random guesses. Example: “The next number could be 12.”	Provides limited hypotheses. Example: “The 4th figure should have 16 squares.”	Makes logical hypotheses. Example: “The 5th figure will have 25 squares.”	Makes comprehensive hypotheses. Example: “This rule is valid for all positive integers.”
Justifying and Convincing	Cannot explain the solution. Example: “It just came to my mind.”	Offers a partial explanation. Example: “Because $4\times4=16$.”	Provides a logical explanation. Example: “The square of the side length is taken.”	Provides a mathematical proof. Example: “The area of a square with side length n is n^2.”

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|Research Article / Araştırma Makalesi|

Education for Sustainable Development: An Investigation of Teacher Candidates' Self-Efficacy Beliefs According to Various Variables

Sürdürülebilir Kalkınma İçin Eğitim: Öğretmen Adaylarının Öz-Yeterlik İnançlarının Çeşitli Değişkenlere Göre İncelenmesi

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Keywords

Self-efficacy

Education for sustainable development

Preschool teacher candidates

Teaching sustainability

Abstract

This study aims to examine how early childhood education teacher candidates' self-efficacy beliefs towards teaching sustainable development differed according to their active life experiences and demographic variables (e.g., gender, grade level, place of childhood, childhood home, having a garden at home, professional activities, membership in a non-governmental organization). 335 early childhood education teacher candidates at differing undergraduate levels from various universities throughout Türkiye constituted the participants. The data were collected using a demographic information form and Education for Sustainable Development Teaching Beliefs Scale. Statistical analyses indicated no statistically significant difference between preservice teachers' gender, grade level, house type, garden status, participation in professional development activities, membership status in non-governmental organizations, repairing and renewing old objects instead of throwing them away or personal teaching efficacy and outcome expectancy belief scores. Significant differences were found in education for sustainable development teaching beliefs scores based on the variables of the place where the individual spent his/her childhood, participating in independent activities regarding the environment, recycling waste, and/or turning off the water while brushing teeth. These study findings confirmed that some demographic variables and active life experiences should be taken into consideration when looking for ways to increase self-efficacy of teacher candidates towards teaching education for sustainable development.

Anahtar Sözcükler

Öz yeterlik

Sürdürülebilir kalkınma için eğitim

Okul öncesi öğretmen adayları

Sürdürülebilir kalkınma öğretimi

Öz

Bu araştırma, okul öncesi eğitimi öğretmen adaylarının sürdürülebilir kalkınma öğretimine ilişkin öz yeterlik inançlarının, etkin yaşam deneyimleri ve demografik değişkenlerine (örneğin; katılımcıların cinsiyeti, lisans eğitimindeki yılı, çocukluğunu geçirdiği yer, çocukluğunu geçirdiği ev, evin bahçesinin durumu ve çevre konusunda profesyonel etkinliklere katılım) göre nasıl farklılaştığını belirlemeyi amaçlamıştır. Araştırma Türkiye'nin çeşitli üniversitelerden farklı lisans düzeylerine sahip 335 okul öncesi öğretmen adayının katılımıyla gerçekleşmiştir. Veriler demografik bilgi formu ve Sürdürülebilir Kalkınma İçin Eğitimi Öğretmeye Yönelik Öz yeterlik İnançları Ölçeği aracılığıyla toplanmıştır. Tanımlayıcı istatistiksel analizler sonucunda okul öncesi eğitimi öğretmen adaylarının sürdürülebilir kalkınma için eğitim kişisel öz yeterlik inancı ve sonuç beklentisi inancı puanları arasında cinsiyete, sınıf düzeyine, ev tipine, bahçe durumuna, profesyonel gelişim etkinliklerine katılım durumuna, sivil toplum kuruluşlarına üyelik durumuna, eski nesneleri atmak yerine tamir etme ve yenileme değişkenlerine göre istatistiksel olarak anlamlı bir farklılık bulunmamıştır. Bireyin çocukluğunu geçirdiği yer, çevre konusunda bağımsız aktivitelere katılma, atıklarını geri dönüşüme atma ve dişleri fırçalarken suyu kapatma değişkenlerine göre okul öncesi eğitimi öğretmen adaylarının sürdürülebilir kalkınma için eğitimi öğretmeye yönelik öz yeterlik inanç puanlarında anlamlı farklılıklar bulunmuştur. Çalışmanın bulguları, okul öncesi eğitimi öğretmen adaylarının sürdürülebilir kalkınma için eğitimi öğretmeye yönelik öz yeterliliklerini artırmanın yollarını ararken bazı demografik değişkenlerin ve etkin yaşam deneyimlerinin göz önünde bulundurulması gerektiğini doğrulamaktadır.

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Introduction

Early years are critical for building individuals' awareness of a sustainable world through sustainability education (Hägglund & Samuelsson, 2009). Considering the potential of teachers to radically influence children's lives during the early years (Institute of Medicine & National Research Council, 2015), the task and importance of providing effective sustainability education to children emerges. Previous studies (Dellinger et al., 2008; Kırkıç & Çetinkaya, 2020; Klassen & Chiu, 2010) reveal teachers' self-efficacy is decisive in realizing effective educational practices. Additionally, teachers' ability to provide children with appropriate environmental education opportunities is shaped during the teacher education process. Therefore, teachers' effort in implementing Education for Sustainable Development (EfSD) can be recognized as having EfSD self-efficacy. Since teachers' self-efficacy progresses from university student to educator during the undergraduate education process, their self-efficacy beliefs towards teaching Sustainable Development (SD) should be developed during their undergraduate education. In this context, revealing the current situation and determinant factors in early childhood education (ECE) teacher candidates' self-efficacy towards SD education constituted the basis of this research. The purpose of the present study is to investigate how self-efficacy beliefs of ECE teacher candidates towards teaching SD differed based on their active life experiences and demographic variables.

The report "Our Common Future" explained SD as meeting present needs without jeopardizing the capacity of next generations to fulfil their own requirements. (Dale & Newman, 2005). This definition provides a framework for investigating issues related to sustainability (Crisostomo & Reinertsen, 2021). In 2015, at the United Nations Sustainable Development Summit, 17 goals and 169 sub-goals were established as a guide for strategies to be implemented globally within the scope of 'Sustainable Development Goals (SDG)' The fourth objective among these goals is to guarantee accessible and fair high-quality education and advocate continuous learning opportunities for everyone. (United Nations [UN], 2015). Within the scope of this goal, the lifelong quality education individuals receive starting from the preschool period contributes to making the world more sustainable. Since preschool teachers, educators, and institutional authorities (principals) are responsible for promoting sustainability in schools (Davis, 2009; Samuelsson, 2011), teachers should educate children as individuals who can make decisions locally and/or globally as well as act in appropriate ways to solve socio-environmental conflicts (Rodríguez-Marín et al., 2020). Therefore, ECE is increasingly perceived as a vital field for sustainability education (Ärlemalm-Hagsér & Samuelsson, 2017). Therefore, there is a growing interest in preschool teachers promoting sustainability within their teaching (Engdahl, 2015; Liu et al., 2022).

Various studies have suggested teacher education programs should support teacher candidates to graduate well prepared and can deliver sustainability education (Maidou et al., 2019; Mills & Tomas, 2013; Nolet, 2009; UNESCO, 2005). In this context, UNESCO published guidelines to reframe teacher education with a focus on sustainability (UNESCO, 2005). Teachers should have professional skills to promote sustainability within their classrooms. For example, teacher self-efficacy is one of the characteristics which affects teaching as well as promoting sustainability in classroom settings (Malandrakis et al., 2019; Moseley et al., 2010).

Self-efficacy is described as a belief a person can accomplish a specific goal (Gist, 1987). Self-efficacy is the outcome of gradually acquiring a complex set of social, linguistic, cognitive, and physical skills (Bandura, 1982). The theory of self-efficacy is a component of social cognitive theory (Bandura, 1977, 1997) which is presented as a model of causal interactions between self and society (Dellinger et al., 2008). People assess and incorporate information about their abilities, then arrange their decisions and actions accordingly (Bandura et al., 1980). In other words, beliefs about our ability to do something have important consequences for whether we will continue and actually accomplish the task (Clark & Newberry, 2019). Basically, teachers' self-efficacy beliefs are reflected in their teaching processes. Currently, as teachers' beliefs influence their teaching methods (Bandura, 1997; Herbert et al., 2020), it is essential to enhance personal teaching efficacy in teacher education (Dahl, 2019; Effeney & Davis, 2013; Poulou, 2007; Stants, 2016). In this context, it is crucial to nurture beliefs on the self-efficacy of teacher candidates in teaching SD before they embark on their professional journeys.

In studies examining self-efficacy of teacher candidates towards SD, the results indicate that prospective teachers who underwent units or courses focused on ESD and/or SD during their undergraduate studies exhibited elevated levels of self-efficacy and confidence in ESD (Demirci & Teksöz, 2017; Murphy et al., 2020). Yet, when undergraduate programs in Türkiye are examined, even though teacher candidates can participate in an elective ESD course, there is no mandatory ESD course for teacher candidates. Merritt et al. (2019) suggest that students' beliefs regarding the appropriateness of sustainability education, attitudes towards SD, locus of control, sustainable consumption behaviors, and self-efficacy can change. In this context, past research has demonstrated statistical significance in terms of variations in self-efficacy beliefs and confidence related to teaching SD subjects concerning the duration of undergraduate education (Malandrakis et al., 2019), enrollment in an environmental educational program (Moseley et al., 2010), and experiences in courses on SD (Demirci & Teksöz, 2017; Gardner, 2009). Although previous research (Malandrakis et al., 2019; Moseley et al., 2010) showed that self-efficacy beliefs affect teachers' ability to apply ESD, gaps remain in research of teacher candidates' self-efficacy during implementation of ESD (Malandrakis et al., 2019). Effective implementation of ESD requires teacher candidates to identify learning prerequisites within the education process as well as utilize appropriate tools to measure their self-efficacy beliefs regarding SDL instruction (Handtke et al., 2022). In this sense, to develop effective ESD self-efficacy, it is necessary to first determine the present situation of teacher candidates. As individuals who have yet to transition into professional teaching life, the relation between self-efficacy beliefs of teacher candidates for teaching SD along with their life experiences and a description of the current situation will all help reveal factors in teacher candidates' education as well as variables related to self-efficacy.

In this context, the purpose of the current study is to investigate self-efficacy beliefs of ECE teacher candidates towards teaching SD based on the following variables: gender, grade level, place of childhood, childhood home, having a garden at home, professional activities regarding the environment, independent activities related to the environment, membership in a non-governmental organization, recycling their waste, preferring to repair and renovate old objects instead of throwing them away, and/or turning off the water while brushing teeth.

Method

Research Design

The present research aimed to assess self-efficacy beliefs of ECE teacher candidates regarding teaching SD across various factors, employed a cross sectional survey study which is a quantitative research approach (Fraenkel et al., 2012).

Population and Sample

All students studying undergraduate preschool teaching at public universities throughout Türkiye comprise the study's population. Whereas the research sample consisted of only 335 ECE teacher candidates attending four state universities within Türkiye. Convenience sampling method was used to identify study participants, and inclusion criterion was any teacher candidate enrolled in an undergraduate preschool teaching department, and no age criterion was considered for participation. Prior to the study, participants were informed regarding the study along with also obtaining their verbal and written consent. Participating preservice teachers' demographic characteristics are presented in Table 1.

Table 1

Demographics of ECE Teacher Candidates

Variables	N	(%)
Gender		
Female	287	85.7
Male	48	14.3
Undergraduate Grade level		
1st year (freshman)	99	29.6
2nd year (sophomore)	109	32.5
3rd year (junior)	36	10.7
4th year (senior)	91	27.2
Place of childhood (Neighborhood where they grew up)		
City center	155	46.3
District	116	34.6
Village/Town	64	19.1
Childhood home-type		
Apartment	207	61.8
Detached house	125	37.3
Other	3	0.9
Having a garden at home		
Yes	222	66.3
No	112	33.4
Professional activities regarding the environment		
Undergraduate course	57	17.0
Extra-curricular activities	70	20.9
All of them	59	17.6
None of them	149	44.5
Independent activity related to the environment		
Environmental cleaning	102	30.4
Planting saplings	73	21.8
None of them	19	5.7
All of them	141	42.1
Membership in non-governmental organization		
Yes	73	21.8
No	262	78.2
Recycling waste		
Yes	208	62.1
No	127	37.9
Prefer to repair and renovate old objects instead of throwing them away		
Yes	180	53.7
No	155	46.3
Turning off the water while brushing teeth		
Yes	317	94.6
No	18	5.4

Table 1 includes descriptive statistical analysis for the participating ECE teacher candidates. For example, among participating teacher candidates, 85.7% were female, 14.3% male, among these 29.6% were university freshman, 32.5% sophomore, 10.7% junior, and 27.2% seniors. Also, 46.3% of teacher candidates reported spending their childhood in the city center, 34.6% within the district (i.e., sub province), and 19.1% in a village/town. Considering where one's childhood was spent, 61.8% lived in an apartment, 37.3% a detached house, and 0.9% in other types of residences. Additionally, 33.4% of candidates did not have a home garden, while 66.3% had a garden at home. Regarding professional activities related to the environment, 17% took undergraduate courses, 20.9% participated in extracurricular activities, 17.6% did them all, and 44.5% did not participate in any environmental activities. In independent activities regarding the environment, 30.4% participated in environmental cleanups, 21.8% in tree planting, 42.1% did both

activities, and 5.7% did not participate in any activity. While 21.8% of ECE teacher candidates were members of non-governmental organizations, 78.2% reported they were not members of any non-governmental organization. Also, when the rates of throwing waste into recycling were examined, it was determined 62.1% of teacher candidates stated recycling, whereas 37.9% did not recycle. Finally, 53.7% of candidates preferred to repair and renew old objects instead of throwing them away, while 46.3% did not, and the rate of teacher candidates who turn off the water while brushing their teeth was 94.6%, the rate of teacher candidates who did not was 5.4%.

Data Collection Procedure

Demographic information form

The form utilized in the study consisted of information regarding the demographics of teacher candidates. The form, prepared by the current study researchers, contained nine items related to teacher candidates' life experiences. For example, information was collected regarding participants' gender, grade level, place of childhood, childhood home, having a garden at home, professional activities related to the environment, independent environmental activities, membership in non-governmental organizations, recycling waste, preferring to repair/renovate old objects instead of throwing them away, and/or turning off the water while brushing their teeth.

Education for sustainable development teaching beliefs scale (EfSD-B)

The ESD scale, established by Stants (2016), was adapted by Köklü Yaylacı and Olgan (2021) for ECE teacher candidates in Türkiye, to test their beliefs about teaching education for sustainable development. scale includes 5-point Likert-type items (1: strongly disagree; 2: disagree; 3: uncertain; 4: agree; 5: strongly agree). On the EfSD-B Scale, higher scores reflect higher levels of self-efficacy. Additionally, confirmatory and exploratory factor analysis was conducted to provide a valid scale. The completed scale structure includes two factors: Outcome Expectancy Beliefs (OEB) and Personal Teaching Efficacy (PTE), which two subscales with eight items each, totaling 16 items. The scale has a minimum score of 16 and maximum of 80, whereas the minimum and maximum subscale scores vary between 8 and 40. Cronbach's alpha coefficients were .82 for the OEB subscale and .79 for the PTE subscale. Approval has been obtained from the authors who developed the scale for its use in the study.

Data Collection Process

Ethics committee approval was received for the research from the Ethics Committee of Çukurova University with the decision number E-91770517-604.01.02-807351 dated 29.09.2023. Data were gathered in October during the fall 2023-24 university semester. ECE teacher candidates studying at four state universities throughout Türkiye were provided with information regarding the study purpose. Next, volunteer teacher candidates provided informed consent and the data collection was conducted through online forms and hard copies. Among participants, 236 responded to the online questionnaire and 99 responded to the printed questionnaire.

Data Analysis

The normality of distribution of participants' ESD self-efficacy scores according to specified variables was examined in this study. Descriptive statistics, skewness, and kurtosis values of ECE teacher candidates' EfSD-B scores according to variables are presented in Table 2.

Table 2

Descriptive Statistics, Skewness and Kurtosis Results of Pre-Service Preschool Teachers' ESD Self-Efficacy Scores According to Variables

Variables	M	SS	Skewness	Kurtosis
Personal teaching efficacy (PTE)	28.73	3.019	-.854	1.443
Outcome expectancy beliefs (OEB)	27.78	3.500	-.230	.491
Total EfSD-B	56.51	5.102	-.345	.582

George and Mallery (2010) suggested that the range of skewness and kurtosis values of +2 to -2 indicate that the data are normally distributed. In Table 2, it is seen that the skewness and kurtosis values of teacher candidates' ESD self-efficacy scores vary between +2 and -2 based on the variables. Thus, parametric tests were used to analyze the data.

Independent groups t tests and ANOVA were applied through SPSS 24.0 program. Analysis were implemented to determine how teacher candidates' self-efficacy belief scores for teaching ESD differed based on: (1) gender, (2) grade level, (3) place of childhood (neighborhood where they grew up) (4) childhood home-type, (5) having a garden at home, (6) professional activities regarding the environment, (7) independent activity related to the environment, (8) membership in non-governmental organization (9) recycling waste (10) prefer to repair and renovate old objects instead of throwing them away (11) turning off the water while brushing teeth.

Findings

In this section, the preservice preschool teachers' findings are presented under two headings: descriptive statistics and inferential statistics.

Descriptive statistics

SD self-efficacy levels of pre-service teachers in this study were examined. Table 3 represents the descriptive statistics results of the data obtained from EfSD-B.

Table 3

Pre-service Preschool Teachers' Scores for EfSD-B

	N	M	SS	Min	Max
Total EfSD-B	335	56.51	5.102	40	72
Personal teaching efficacy (PTE)	335	28.73	3.019	18	37
Outcome expectancy beliefs (OEB)	335	27.78	3.500	14	36

Table 3 shows that the total EfSD-B scores of pre-service preschool teachers ranged between 40 and 72 (M=56.51; SS=5.102), their PTE scores ranged between 18 and 37 (M=28.73; SS=3.019) and their OEB scores ranged between 14 and 36 (M=27.78; SS=3.500). The median for the total EfSD-B scores of pre-service teachers was 57, while it is 28 for the PTE and 29 for OEB. When these values are taken into consideration, it is understood that pre-service preschool teachers' EfSD-B total score and scores in sub-dimensions, which are PTE and OEB, are at a moderate level.

Inferential Statistics

It was examined whether pre-service preschool teachers' self-efficacy beliefs towards ESD teaching varied according to the variables of gender, grade level, place of childhood, childhood home, having a garden at home during childhood, professional development activities on the environment, independent activities on environment, membership in a non-governmental organization related to the environment, throwing waste into recycling, repairing and using old objects, turning off the water while brushing teeth.

Table 4 shows the results of the T-test, which was used to examine whether pre-service teachers' self-efficacy beliefs for teaching ESD differed significantly by gender.

Table 4

T-test Results According to Gender

	Gender	N	$\bar{X}$	SS	T	df	p
Total EfSD-B	Female	287	56.48	5.025	-.255	333	0.799
	Male	48	56.69	5.597			
Personal teaching efficacy (PTE)	Female	287	27.73	3.509	-.688	333	0.492
	Male	48	28.10	3.466			
Outcome expectancy beliefs (OEB)	Female	287	28.76	2.983	.367	333	0.714
	Male	48	28.58	3.254			

It was shown in Table 4 that gender did not make a significant difference in participating teacher candidates' total self-efficacy scores for ESD (t(333) = -.255, p = .79), PTE (t(333) = -.688, p = .492) and OEB scores (t(333) = .367, p = .714).

Additionally, one-way ANOVA was used to examine whether teacher candidates' self-efficacy beliefs towards ESD teaching varied according to grade level. The findings obtained are presented in Table 5.

Table 5

ANOVA Results for Teacher Candidates' Self-Efficacy Related to Teaching ESD According to Grade Level

	Variance	KT	SD	KO	F	p
Total EfSD-B	Between groups	63.941	3	21.314	0.817	0.485
	Within groups	8631.749	331	26.078		
	Total	8695.690	334			
Personal teaching efficacy (PTE)	Between groups	6.993	3	2.331	0.189	0.904
	Within groups	4084.099	331	12.339		
	Total	4091.093	334			
Outcome expectancy beliefs (OEB)	Between groups	36.908	3	12.303	1.354	0.257
	Within groups	3006.913	331	9.084		
	Total	3043.821	334			

When Table 5 was analyzed, participants' scores did not significantly change according to grade level for total ESD self-efficacy (F = .817, p > .05), PTE (F = .189, p > .05), or OEB (F = 1.354, p > .05).

One-way analysis of variance (ANOVA) was conducted to identify whether participants' self-efficacy beliefs towards ESD teaching varied according to the region where they spent their childhood (place of childhood). These findings are presented in Table 6.

Table 6

ANOVA Results for Teacher Candidates' Self-Efficacy Related to Teaching ESD According to Region Where They Spent Their Childhood (Place Of Childhood)

	Variance	KT	SD	KO	F	p
Total EfSD-B	Between groups	100.119	2	50.059	1.934	0.146
	Within groups	8595.571	332	25.890		
	Total	8695.690	334			
Personal teaching efficacy (PTE)	Between groups	5.413	2	2.706	0.220	0.803
	Within groups	4085.680	332	12.306		
	Total	4091.093	334			
Outcome expectancy beliefs (OEB)	Between groups	64.511	2	32.255	3.594	0.029*
	Within groups	2979.310	332	8.974		
	Total	3043.821	334			

As shown in Table 6, teacher candidates' total self-efficacy scores for teaching ESD (F = 1.934; .146; p > 05) and PTE scores (F = .220; .803; p > 05) did not significantly change according to region where they spent their childhood, whereas their OEB scores did change significantly (F = 3.594; .029; p < 05). According to the results of the Scheffe test conducted to determine which regions were significantly different, teacher candidates who spent their childhood in a "suburban" district (M = 29.32, *SD* = 3.22) received greater OEB scores than teacher candidates who spent their childhood in the city center (M = 28.34, *SD* = 2.99).

ANOVA was used to examine whether participants' self-efficacy beliefs towards teaching ESD varied according to the type of home they spent their childhood (childhood home). These findings are presented in Table 7.

Table 7

ANOVA Results Regarding Self-Efficacy of Participants for Teaching ESD According to Childhood Home

	Variance	KT	SD	KO	F	p
Total EfSD-B	Between groups	27.378	2	13.689	0.524	0.592
	Within groups	8668.311	332	26.109		
	Total	8695.690	334			
Personal teaching efficacy (PTE)	Between groups	1.111	2	.556	0.045	0.956
	Within groups	4089.981	332	12.319		
	Total	4091.093	334			
Outcome expectancy beliefs (OEB)	Between groups	28.218	2	14.109	1.553	0.213
	Within groups	3015.603	332	9.083		
	Total	3043.821	334			

Table 7 shows that participants' total self-efficacy scores for teaching ESD, PTE, and OEB scores did not vary significantly according to region where teachers spent their childhood (F = .524, .045; 1.553 p > 05).

Thus, to determine whether teacher candidates' self-efficacy beliefs towards ESD changed according to having a garden at home during childhood, a t-test was applied. A single missing value (<1%) was identified in the dataset. Given the negligible proportion of missing data, no imputation procedure was applied. The t-test results are shown in Table 8.

Table 8

T-test Results of Teacher Candidates' Self-Efficacy for Teaching ESD According to Having a Garden at Home During Childhood

	Having a garden	N	$\bar{X}$	SS	T	df	p
Total EfSD-B	no	112	56.66	5.179	0.332	332	0.740
	yes	222	56.46	5.072			
Personal teaching efficacy (PTE)	no	112	27.89	3.286	0.368	332	0.713
	yes	222	27.74	3.608			
Outcome expectancy beliefs (OEB)	no	112	28.77	3.004	0.134	332	0.893
	yes	112	28.72	3.037			

It was shown in Table 8 that having a garden at home during childhood did not make a significant difference in participating teacher candidates' total self-efficacy scores for ESD (t(332) = .332, p = .74), PTE (t(332) = .368, p = .713) and OEB scores (t(332) = .134, p = .893).

Again, one-way ANOVA was used to determine whether participants' EfSD-B self-efficacy beliefs towards ESD changed according to participation in professional development activities related to the environment. These findings are presented in Table 9.

Table 9

ANOVA Results on Teacher Candidates' Self-Efficacy for Teaching ESD According to Participation in Professional Development Activities

	Variance	KT	SD	KO	F	p
Total EfSD-B	Between groups	54.144	3	18.048	0.691	0.558
	Within groups	8641.545	331	26.107		
	Total	8695.690	334			
Personal teaching efficacy (PTE)	Between groups	9.021	3	3.007	0.244	0.866
	Within groups	4082.071	331	12.333		
	Total	4091.093	334			
Outcome expectancy beliefs (OEB)	Between groups	29.062	3	9.687	1.064	0.365
	Within groups	3014.759	331	9.108		
	Total	3043.821	334			

As seen in Table 9, teacher candidates' participation in professional development activities related to the environment did not create a significant difference on their total self-efficacy scores for EfSD-B, PTE, and/or OEB (F = .691; .244; 1.064 p > 05).

One-way ANOVA was applied to examine whether teacher candidates' self-efficacy beliefs towards ESD changed according to independent activity regarding the environment. The analysis findings are shown in Table 10.

Table 10

ANOVA Results of Teacher Candidates' Self-Efficacy for Teaching ESD According to Their Participation in Environmental Activities (Independent Environmental Activities)

	Variance	KT	SD	KO	F	p
Total EfSD-B	Between groups	330.607	3	110.202	4.361	0.005*
	Within groups	8365.083	331	25.272		
	Total	8695.690	334			
Personal teaching efficacy (PTE)	Between groups	80.005	3	26.668	2.201	0.088
	Within groups	4011.087	331	12.118		
	Total	4091.093	334			
Outcome expectancy beliefs (OEB)	Between groups	108.316	3	36.105	4.071	0.007*
	Within groups	2935.505	331	8.869		
	Total	3043.821	334			

As shown in Table 10, while teacher candidates' PTE scores did not significantly change according to their participation in environmental activities (F = 2.201; .088; p > 05), total EfSD-B (F = 4.361; .005; p < .05), and OEB scores (F = 4.071; ,007; p < .05) did change significantly. The Scheffe test, used to determine which groups were significantly different, revealed teacher candidates who participated in all the environmental activities (i.e., sapling planting, environmental cleaning, etc.) (M = 57.60, SD = 4.75) had higher total self-efficacy scores and OEB scores for teaching ESD than those who did not participate in these activities (M = 54.32, SD = 5.30).

To determine whether teacher candidates' self-efficacy beliefs towards ESD varied according to their membership status in non-governmental organizations, a t-test was applied. The findings are presented in Table 11.

Table 11

T-test Results on Teacher Candidates' Self-Efficacy for Teaching ESD According to Their Membership Status in a Non-Governmental Organization

	Membership in a non-governmental organisation	N	$\bar{X}$	SS	t	p
Total EfSD-B	yes	73	57.21	4.672	1.312	0.191
	no	262	56.32	5.208	1.395	0.166
Personal teaching efficacy (PTE)	yes	73	28.07	3.322	0.790	0.430
	no	262	27.70	3.550	0.820	0.414
Outcome expectancy beliefs (OEB)	yes	73	29.14	2.795	1.300	0.195
	no	262	28.62	3.074	1.371	0.173

As can be seen in Table 11, no significant difference was found between teacher candidates' total self-efficacy scores for teaching ESD, PTE, and OEB scores according to their membership in a non-governmental organization.

Again, to determine whether self-efficacy beliefs of teacher candidates' towards ESD changed according to whether they repaired and renewed old objects instead of throwing them away, t-test analysis were applied (see Table 12).

Table 12

T-test Results Related to Self-Efficacy of Teacher Candidates Towards Teaching ESD According to Repairing and Renewing Old Objects Instead of Throwing Them Away

	Repairing and renewing old objects	**N**	**$\bar{X}$**	**SS**	**t**	**p**
Total EfSD-B	no	155	56.18	5.274	-1.108	0.269
	yes	180	56.80	4.947	-1.103	0.271
Personal teaching efficacy (PTE)	no	155	27.59	3.776	-0.946	0.345
	yes	180	27.95	3.245	-0.936	0.350
Outcome expectancy beliefs (OEB)	no	155	28.59	3.027	-0.775	0.439
	yes	180	28.85	3.015	-0.775	0.439

According to Table 12, teacher candidates' repairing and renewing old objects instead of throwing them away did not create a statistically significant difference in their EfSD-B, PTE, and/or OEB scores ($p > .05$).

Thus, to determine whether teacher candidates' self-efficacy beliefs towards ESD changed according to recycling waste, a t-test was applied. These findings are presented in Table 13.

Table 13

T-test Results Related to Teacher Candidates' Self-Efficacy for Teaching ESD According to Recycling Waste

	Recycling waste	**N**	**$\bar{X}$**	**SS**	**T**	**df**	**p**
Total EfSD-B	no	127	55.05	5.299			
	yes	208	57.41	4.774	-4.211	333	0.000
Personal teaching efficacy (PTE)	no	127	27.21	4.023			
	yes	208	28.13	3.097	-2.202	216.436	0.029
Outcome expectancy beliefs (OEB)	no	127	27.83	2.791			
	yes	208	29.28	3.028	-4.361	333	0.000

As can be seen in Table 13, significant difference was found between total EfSD-B scores ($t(333) = -4.211$, $p < .05$), PTE ($t(216.436) = -2.202$, $p < .05$), and OEB scores ($t(333) = -4.361$, $p < .05$) for teacher candidates who recycle or do not recycle waste. That is, teacher candidates who recycled their waste had higher total self-efficacy scores for EfSD-B, PTE, and OEB than teacher candidates who did not recycle their waste.

T-test analysis used to examine whether teacher candidates' self-efficacy beliefs towards ESD varied according to whether they turned off the water while brushing their teeth, are shown in Table 14.

Table 14

T-test Results of Self-Efficacy of Teacher Candidates for Teaching ESD According to Turning Off the Water While Brushing Teeth

	Turning off the water while brushing teeth	**N**	**$\bar{X}$**	**SS**	**T**	**df**	**p**
Total EfSD-B	no	18	53.89	6.516	-2.257	333	0.025
	yes	317	56.66	4.982			
Personal teaching efficacy (PTE)	no	18	25.83	5.159	-1.674	17.828	0.112
	yes	317	27.89	3.359			
Outcome expectancy beliefs (OEB)	no	18	28.06	3.115	-.976	333	0.330
	yes	317	28.77	3.014			

When Table 14 was examined, there was a significant difference in the total EfSD-B scores of teacher candidates' turning off the water while brushing their teeth ESD ($t(333) = -2.257$, $p = .025$).

Discussion

The present study focused on determining how self-efficacy beliefs of ECE teacher candidates towards teaching SD differed according to their active life experiences and/or demographic variables. Findings from this study can contribute to future studies by demonstrating preservice teachers' attitudes are an important factor for teaching SD.

First, it was determined in this study teacher candidates' self-efficacy beliefs towards teaching SD did not vary according to gender. This finding demonstrated that whether preschool teacher candidates were male or female did not make a difference regarding how competent they saw themselves related to teaching SD. A Finnish study similarly found no gender difference in subject teachers' perceptions of their self-efficacy in sustainable education competence (Uitto & Saloranta, 2017). On the other hand, Tuncer et al. (2006) reported greater awareness of SD in female teacher candidates. These two findings highlight the distinction between awareness and self-efficacy, even though awareness may contribute to the development of self-efficacy. Self-efficacy refers to an individual's belief that a person can accomplish a specific goal (Gist, 1987). In Türkiye, teacher education programs provide male and female teacher candidates with similar training and learning opportunities, which equalize their beliefs of competence in teaching SD. Therefore, it is expected that this study will not reveal any gender differences in self-efficacy beliefs in teaching SD.

Additionally, present study indicated that self-efficacy beliefs of teacher candidates towards teaching SD did not differ depending on their university grade level. This finding revealed the time spent by teacher candidates at university did not affect their self-confidence in providing SD education. Similarly, various research (Effeney & Davis, 2013; Köklü Yaylacı & Olgan, 2021) found the time spent in undergraduate education does not affect self-efficacy levels of teacher candidates in teaching SD. Uludağ et al. (2017) also found the behaviors of preservice preschool teachers regarding a sustainable environment did not change according to their university grade level. In Türkiye, the absence of a compulsory course on SD as part of the undergraduate preschool teaching curriculum may have caused there to be no difference detected between grade levels. Moreover, its content should strongly emphasize practical implementations- integrating 'practical hours' into the course credits, to enable teacher candidates to relate SD to their own lives, rather than relying solely on theoretical knowledge.

Furthermore, the present study revealed that the self-efficacy beliefs of preservice teachers in teaching SD did not exhibit significant differences based on the type of residence during their childhood, the presence of a garden, or their affiliation with non-governmental organizations. This finding corresponded with Köklü Yaylacı and Olgan (2021), who found preservice teachers' self-efficacy belief levels for teaching SD did not vary depending on whether the house they lived in as a child had a garden or not as well as their membership in student clubs. These results suggest that teacher candidates' self-efficacy in teaching SD would be supported by theoretical coursework and practice-based courses rather than residential area in childhood (residence during their childhood, the presence of a garden) Furthermore, finding in the present study is confirmed in Uludağ et al. (2017), who discovered that becoming a member of a non-governmental organization does not influence teacher candidates' actions towards sustainable environment. This may be because NGO membership does not necessarily provide active experience and may only involve being registered by name. Therefore, it may not considerably improve self-efficacy belief for teaching SD.

Additionally, the current study revealed that participation in professional development activities (i.e., taking undergraduate courses regarding the environment and/or participating in extracurricular activities) did not change preservice preschool teachers' self-efficacy beliefs towards teaching SD. Although it has been shown in previous studies that taking environmental courses prepares preservice teachers for SD education (Köklü Yaylacı & Olgan, 2021; Moseley et al., 2010) and courses taken on science teaching increases teaching self-efficacy (Mulholland et al., 2004), there are also studies (e.g., Hechter, 2011) which argue the number of teaching courses taken has no effect on teaching self-efficacy. In this study, teacher candidates indicated that there was no compulsory undergraduate course regarding SD as part of the curricula at universities where these participating teacher candidates attended. Additionally, in Türkiye efforts at incorporating SD into higher education remain in the early stages (Tuncer et al., 2006). This is why teacher candidates have the possibility of acquiring information regarding SD solely as part of content from 'Early Childhood Science

Education' and 'Environmental Education' courses. Even though SD is included due to the nature of these courses, it is likely they tend to focus primarily on the environmental component of sustainability. Therefore, the finding obtained in this current study does not reflect any inference about whether a comprehensive SD education course, based directly on SD, would create a change in teacher candidates' self-efficacy beliefs towards teaching SD.

Our research findings shed light on the issue that the expectation beliefs of teacher candidates who spent most of their childhood in the district (i.e., suburban) were higher than those who spent most of their childhood in the city center. Therefore, it can be concluded the district where individuals lived during their childhood is positively associated with their beliefs about EfSD-B in adulthood. This finding is inconsistent with Köklü Yaylacı and Olgan (2021), who found the ESD self-efficacy beliefs of teacher candidates living are not different between villages and city centers. On the other hand, this research supported studies which found individuals who spent their childhood in rural areas exhibit more positive behaviors towards the environment due to having more opportunities to be in nature more (Hsu, 2009; Kahriman Pamuk, 2019). The present finding in the study may be a result of teacher candidates having found opportunities to spend time in the outdoors and natural environments when living in districts compared to the city center during their childhoods. As a result, this indicated they may have evaluated themselves as more competent in teaching SD.

It was also determined teacher candidates' outcome expectancy beliefs differed depending on whether they participated in independent environmentally related activities or not. That is, the outcome expectancy beliefs of preservice preschool teachers who participated in environmental activities both cleaning the environment and planting saplings were higher than preservice teachers who did not participate in any of these activities. In this respect, teacher candidates who carried out all independent environmental activities had stronger beliefs that their role was crucial in children's success in learning SD, than those who did not carry out all such activities. Participating in applied activities has previously been found as affective in preservice teachers' favorable attitude towards the environment (Özmen & Özdemir, 2016). Furthermore, for preservice teachers to participate in cleaning the environment and planting saplings may be related to their belief that there is something that can be done for the environment. Thus, due to this belief, they may believe children's potential contribution to SD can be improved through education, and as a result, their own contribution is valuable.

Importantly, the present study indicated that there was a significant difference between the EfSD beliefs, PTE, and OEB scores of teacher candidates who recycled their waste and those who did not. Therefore, it was determined that teacher candidates who recycled their waste had higher self-efficacy beliefs towards teaching SD. Additionally, the personal self-efficacy beliefs and outcome expectancy beliefs of teacher candidates who participated in recycling activities were higher. To illustrate, teacher candidates who were careful about recycling as a form of pro-environment behavior considered themselves competent in providing SD education to children. At the same time, these teacher candidates also believed they could be well organized when providing SD education in the future (personal self-efficacy belief) as well as their efforts were valuable in children's success (outcome expectancy belief). Gan and Gal (2018) emphasized educators should focus on skills which increase self-efficacy in sustainability education due to these skills being the primary determinants to increase self-efficacy as part of the content of sustainability-related courses. Based on this, it was postulated that promoting the involvement of teacher candidates in activities like recycling could enhance their EfSD beliefs.

It was also shown in this study, that a significant difference was present between the EfSD belief scores of teacher candidates who turned off the water while brushing their teeth and those who did not. That is, those who turned off the water while brushing their teeth had higher self-efficacy beliefs towards teaching SD. Accordingly, preservice preschool teachers who acted diligently to reduce use of natural resources as a form of pro-environment behavior believed they could effectively teach SD to children. Furthermore, these same preservice teachers had high expectations regarding the results of SD education. This finding aligns with Bandura's (1995) notion which mentions one dimension of self-efficacy as the emotional process and people hesitate to undertake a task when they experience difficult processes. For example, teacher candidates who integrated behaviors such as recycling waste and conserving water in their daily life were likely to have more

positive emotions and feel more competent towards teaching SD, and they could put their skills in protecting the environment to work.

Conversely, preservice teachers' EfSD beliefs did not differ significantly depending on whether they took care to repair or renew old objects instead of throwing them away. Reusing old objects is also considered a form of pro-environment behavior like recycling and less use of natural resources. Although it was revealed that the EfSD belief of teacher candidates who recycled their waste and/or took care to turn the water off when brushing their teeth was higher than those who did not follow these behaviors; no evidence was found teacher candidates who were careful to repair and reuse objects had higher EfSD beliefs. This finding may be a reflection of the current consumption habits and economic context in Türkiye, where the cost of purchasing new items is frequently lower than fixing old ones, potentially limiting repair and reuse behaviors and their influence on self-efficacy in teaching SD.

Overall, among all results in the present study, it was particularly notable that preservice teachers' self-efficacy beliefs in teaching SD differed when they were actively involved in firsthand experiences. It is widely recognized that teachers' self-efficacy enhances students' competencies and their efforts to overcome difficulties (Ross et al., 2001). Accordingly, for students to develop their sustainability competencies and solve their problems, it is crucial that preservice teachers, as the future educators, gain firsthand experiences related to sustainable development as part of their training.

Limitations

Additionally, the present study was also limited to ECE teacher candidates who studied at one of four different universities located in Türkiye. Further studies which investigate the ESD self-efficacy of teacher candidates from other regions of Türkiye should be conducted. In future studies, different variables related to teacher candidates' ESD self-efficacy can be taken into consideration. For example, it was critical that teacher candidates understand the basic principles of SD as well as realize sustainability is not limited to recycling.

Recommendations

Considering that ECE teacher training curricula generally addresses sustainability limited only to environmental education, it is recommended a course which includes more comprehensive dimensions of sustainability be added to the curriculum. Engaging in activities related to the sustainable development would provide additional support for teacher candidates, enhancing their self-efficacy beliefs in teaching SD education. In this regard, course content in curricula should be designed to encourage teacher candidates' active participation in various sustainability-related activities. Integrating 'practical hours' into the course credits would be an effective way to encourage teacher candidates' active participation into relevant activities, rather than relying solely on theoretical knowledge. In line with this perspective, the study results underscored the significance of undergraduate education as a platform for teachers to cultivate their self-efficacy in teaching SD through extended and integrated educational practices.

Conclusion

This study contributed to relevant literature regarding self-efficacy beliefs of teacher candidates towards teaching SD. On the other hand, the present research had some limitations. First, data used in this study were based on the statements of teacher candidates. In future studies, self-efficacy beliefs regarding SD teaching can be examined by using methods such as observation and/or interviews. Second, none of participating teacher candidates had taken a comprehensive course about teaching SD. This situation led to limited inference about whether teacher candidates' self-efficacy beliefs towards teaching SD increased in connection with the course they had taken regarding SD. Finally, an intervention study, which can examine differences in self-efficacy beliefs of preservice teachers if they attend a course where SD is addressed holistically, can be conducted for this purpose.

Author's Note

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CRediT authorship contribution statement

N. Temiz: Conceptualization, Methodology, Data Collection, Analysis, Writing – Original Draft, Review & Editing. E. N. Altaş Kuşhan: Conceptualization, Methodology, Data Collection, Analysis, Writing – Original Draft, Review & Editing. R. Turgut Kurt: Conceptualization, Methodology, Data Collection, Analysis, Writing – Original Draft, Review & Editing. İ. Gürgah Oğul: Conceptualization, Methodology, Data Collection, Analysis, Writing – Original Draft, Review & Editing.

Declaration of Conflicting Interests

There is no personal or financial conflict of interest between the authors of the article within the scope of the study.

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Declaration of AI Usage Statement

The authors affirm that no AI tools were employed in the preparation of this article

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|Research Article / Araştırma Makalesi|

Pre-service Teachers' Preferences and Experiences Regarding Mind and Intelligence Games

Öğretmen Adaylarının Akıl ve Zekâ Oyunlarına Yönelik Tercih ve Deneyimleri

Ahmet Melih Güneş[1], Eyup Yünkül[2]

Keywords

Mind and intelligence games

Pre-service teachers

Cognitive development

Affective experiences

Educational contexts

Abstract

This study aims to examine pre-service teachers' preferences for and experiences with mind and intelligence games. The study employed a phenomenological research design and included 19 pre-service teachers studying at a faculty of education. Data were collected through semi-structured interviews and analyzed using content analysis. The findings indicate that participants preferred games based on motivation, higher-order thinking, and contextual factors. The games were found to enhance problem-solving, strategic thinking, and planning skills cognitively; promote enjoyment, self-confidence, excitement, happiness, and relaxation affectively; and foster interaction, collaboration, empathy, and a sense of competition socially. Although participants reported certain cognitive and social challenges during gameplay, they emphasized that the use of these games as instructional tools increased motivation and contributed positively to learning processes. Overall, the study demonstrates that mind and intelligence games support both cognitive and affective development and can serve as effective tools in teaching and learning contexts.

Anahtar Sözcükler

Akıl ve zeka oyunları

Öğretmen adayları

Bilişsel gelişim

Duyuşsal gelişim

Eğitsel bağlamlar

Öz

Bu çalışma, öğretmen adaylarının zekâ ve akıl oyunlarına yönelik tercihlerini ve deneyimlerini incelemeyi amaçlamaktadır. Araştırmada fenomenolojik desen kullanılmış ve bir eğitim fakültesinde öğrenim gören 19 öğretmen adayıyla çalışılmıştır. Veriler yarı yapılandırılmış görüşmeler yoluyla toplanmış ve içerik analizi ile çözümlenmiştir. Bulgular, öğretmen adaylarının oyunları motivasyon, üst düzey düşünme ve bağlamsal etkenler doğrultusunda tercih ettiklerini göstermektedir. Oyunların bilişsel açıdan problem çözme, stratejik düşünme ve planlama becerilerini geliştirdiği; duyuşsal açıdan eğlence, özgüven, heyecan, mutluluk ve rahatlama sağladığı; sosyal açıdan ise etkileşim, iş birliği, empati ve rekabet duygusunu desteklediği belirlenmiştir. Katılımcılar oyun sürecinde bazı bilişsel ve sosyal zorluklarla karşılaştıklarını ifade etmekle birlikte, bu oyunların öğretim sürecinde materyal olarak kullanılmasının motivasyonu artırdığını ve öğrenme süreçlerine olumlu katkı sağladığını vurgulamışlardır. Sonuç olarak, akıl ve zekâ oyunlarının hem bilişsel hem de duyuşsal gelişimi desteklediği ve öğretim süreçlerinde etkili bir araç olarak kullanılabileceği ortaya konmuştur.

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Introduction

In today's knowledge society, students are expected to move beyond being passive recipients of information and to develop as critical thinkers, problem solvers, and creative individuals. This transformation is grounded in pedagogical perspectives that emphasize the integration of cognitive and motivational dimensions of learning, drawing on constructivist and sociocultural theories, flow theory, and frameworks related to 21st-century skills (Dewey, 1938; Vygotsky, 1978; Csikszentmihalyi, 1990; Trilling & Fadel, 2009). Traditional instructional methods are often deemed insufficient, particularly for students who struggle with attention or exhibit low motivation; this situation underscores the growing need for innovative approaches that are both engaging and conducive to deep learning.

In response to this need, mind and intelligence games have emerged as an innovative approach that can support active and meaningful learning experiences. Mind and intelligence games are generally described as activities that involve strategic thinking, planning, logical reasoning, attention, and problem-solving (Gobet & Campitelli, 2006; Güneş & Yünkül, 2021). These games typically include activities such as chess, Sudoku, mangala, tangram, and various logic- and puzzle-based games. Previous studies suggest that engaging in such games may contribute to the development of cognitive skills such as reasoning, problem-solving, and attention (Aliyari et al., 2021; Sala & Gobet, 2016; Blanch, 2022). In addition to cognitive benefits, these games may also support affective characteristics such as persistence, motivation, and self-regulation (Ryan & Deci, 2000; Güneş, 2024). Furthermore, gameplay environments can encourage focused engagement and intrinsic motivation, which are closely related to flow experiences in learning processes (Csikszentmihalyi, 1990; Kiili, 2005).

Recent meta-analytic studies indicate that brain training and intelligence games yield improvements in cognitive functioning, processing speed, and working memory (Somaa et al., 2025). Effect sizes vary from small to moderate, depending on the duration and design of the interventions. These findings suggest that mind and intelligence games may offer cognitively stimulating learning environments that support the development of higher-order thinking skills. In educational contexts, such potential has drawn increasing attention to the use of these games as instructional tools. Integrating mind and intelligence games into teacher education may therefore contribute not only to pre-service teachers' cognitive development but also to their pedagogical preparedness.

This study aims to examine pre-service teachers' preferences for and experiences with mind and intelligence games through a phenomenological lens. It seeks to contribute to understanding the cognitive, affective, and pedagogical implications of game-based learning within the context of teacher education.

Theoretical Foundations

This study examines mind and intelligence games from four primary theoretical perspectives: constructivist learning, sociocultural theory, executive functions, and flow theory. The constructivist learning theory posits that individuals actively construct knowledge. Within this framework, mind and intelligence games provide interactive environments that actively engage learners in the problem-solving process, fostering skills such as hypothesis generation and testing (Dewey, 1938).

Vygotsky's (1978) sociocultural theory emphasizes that learning is inherently a social activity. Mind and intelligence games facilitate learning through peer interaction and collaboration within the zone of proximal development. This creates a rich experience that enhances both individual and social learning skills among pre-service teachers. The executive functions framework offers a strong theoretical basis for understanding the cognitive effects of these games. Mind and intelligence games may engage these components of executive functions by requiring attention, working memory, and cognitive flexibility during gameplay (Diamond, 2013; Aliyari et al., 2021).

Finally, Csikszentmihalyi's (1990) flow theory provides a compelling explanation for the motivational aspects of gameplay. Flow refers to a state of complete focus and intrinsic motivation that arises when there is a balance between an individual's skills and the level of challenge. For pre-service teachers, experiencing flow not only enhances learning during gameplay but also fosters the desire to design similar learning environments for their future students.

From the perspective of teacher education, integrating mind and intelligence games into pre-service teacher training may support the development of pedagogical and instructional competencies. Game-based learning environments allow pre-service teachers not only to experience cognitive and motivational aspects of learning but also to reflect on how such approaches can be applied in classroom practice. Studies conducted in teacher education contexts indicate that engaging with game-based activities can enhance prospective teachers' engagement, instructional creativity, and awareness of student-centered learning environments (Rodríguez-Ferrer et al., 2023). Therefore, examining pre-service teachers' experiences with mind and intelligence games may provide important insights into how such tools can be integrated into teacher education programs and future teaching practices.

Cognitive Effects of Mind and Intelligence Games

Research on the cognitive effects of mind and intelligence games has increased significantly over the past two decades, with chess and Sudoku emerging as primary areas of focus. Sala and Gobet's (2016) meta-analysis reported a small positive effect of chess instruction on academic achievement. More recent analyses by Blanch (2022) indicate that chess training strengthens problem-solving and reasoning skills, though the transfer of these skills to other domains remains limited.

Studies on Sudoku and logic puzzles suggest that these games improve attention, working memory, and numerical reasoning abilities (Aliyari et al., 2021). Individuals with higher working memory capacity tend to perform better in these games, and regular gameplay may further enhance memory performance. However, the evidence for far-transfer effects remains limited (Hampshire et al., 2019), highlighting the importance of explicitly defining transfer goals when designing cognitive or strategy-based games.

21st-Century Skills and Pedagogical Potential

Qian and Clark (2016) indicate that game-based learning supports the development of 21st-century skills, including problem-solving, critical thinking, creativity, and collaboration. These competencies are increasingly emphasized in contemporary education as essential skills that enable learners to adapt to rapidly changing social, technological, and professional environments.

According to the Partnership for 21st Century Learning (P21) framework, 21st-century skills include competencies such as critical thinking, problem-solving, creativity, collaboration, and communication. In educational contexts, these skills are considered key learning outcomes that prepare students for both academic success and future professional life. Mind and intelligence games may contribute to the development of several of these competencies by encouraging strategic thinking, problem-solving, decision-making, and collaborative interaction among learners. In this sense, such games can provide meaningful learning environments that support the development of higher-order thinking and interactive learning processes associated with 21st-century skills.

Applications in the Context of Türkiye

In Türkiye, since 2012, the Ministry of National Education (MoNE) has incorporated the "Mind and Intelligence Games" course into the curriculum, and in 2023, this module was restructured into six learning domains: reasoning-processing, verbal, memory, strategy, geometric-mechanical, and intelligence questions. In addition, digital tools such as the "Intelligence Games Implementation Training Course" and the GriCeviz platform have been developed (MoNE, 2022), and a substantial number of teachers have been trained. However, improvements are needed regarding the validity of assessment and evaluation, accessibility of materials, and time management in these implementations.

Güneş and Yünkül (2021) noted that intelligence games contribute to students' cognitive, affective, and social development. Nevertheless, there is a need for a systematic examination of pre-service teachers' subjective experiences. Güneş (2024) examined teachers' perspectives on intelligence games and emphasized the need for further training and support to enhance the effectiveness of these practices. Güneş and Güneş (2024) investigated pre-service teachers' experiences with intelligence games and demonstrated that these experiences shape their pedagogical approaches. However, existing studies have largely focused either on teachers' perspectives or on general experiences of pre-service teachers, without examining in depth the factors influencing their preferences for mind and intelligence games and how these preferences

relate to their perceptions of using such games in instructional settings. Therefore, this study seeks to extend the existing literature by exploring both the preferences and experiences of pre-service teachers and by examining how these experiences shape their views on integrating mind and intelligence games into future teaching practices.

Furthermore, a study examining social studies teachers' perspectives on educational games indicated that these games enhance students' historical empathy, decision-making, and analytical thinking skills (Bostan & Turan, 2023). Similarly, research on the impact of mind and intelligence games by instructors revealed that these games improve students' problem-solving, logical reasoning, and strategic planning abilities (Kul & Kel, 2021). These findings highlight the importance of intelligence games in education and the necessity of developing teachers' attitudes toward these games.

The literature indicates that mind and intelligence games support cognitive and affective development; however, limited attention has been given to how pre-service teachers perceive, prefer, and experience these games within teacher education contexts. Although the module has been implemented on a large scale in Türkiye, research focusing on pre-service teachers' preferences for mind and intelligence games, the factors influencing these preferences, and how they interpret these experiences in relation to their future teaching practices remains limited. Therefore, examining both the preferences and experiences of pre-service teachers may provide deeper insights into the pedagogical potential of mind and intelligence games in teacher education.

In this context, this study aims to address this gap in the literature by examining pre-service teachers' preferences for and experiences with mind and intelligence games and how these relate to their perceptions of using such games in educational settings. Although previous studies have largely focused on the cognitive effects of intelligence games on students, limited research has explored pre-service teachers' experiential perspectives in teacher education contexts. Therefore, this study provides insights into the cognitive, affective, and pedagogical meanings that pre-service teachers attribute to mind and intelligence games. The findings may contribute to teacher education programs by informing the integration of game-based learning practices and by offering implications for educators and policymakers interested in the pedagogical use of intelligence games.

Accordingly, this study seeks to answer the following research question:

How do pre-service teachers experience mind and intelligence games?

In line with this objective, the following sub-questions were formulated:

1. How do pre-service teachers explain their reasons for choosing mind and intelligence games?

2. What are the sources of pre-service teachers' influence regarding mind and intelligence games?

3. According to pre-service teachers, what are the contributions of mind and intelligence games to cognitive skills?

4. According to pre-service teachers, what are the contributions of mind and intelligence games to affective skills?

5. What challenges do pre-service teachers encounter during the process of playing mind and intelligence games?

6. What are pre-service teachers' perceptions regarding the use of mind and intelligence games as instructional materials?

7. What are pre-service teachers' opinions on the implementation of mind and intelligence games in the classroom setting?

Method

This study is a qualitative study aimed at gaining an in-depth understanding of pre-service teachers' experiences with mind and intelligence games. A phenomenological design was adopted for the study.

According to Moustakas (1994), phenomenological research seeks to explore the essence and meaning of individuals' experiences regarding a particular phenomenon. This approach provides an appropriate framework for understanding participants' experiences with mind and intelligence games, the meanings they assign to these experiences, and how they perceive the cognitive, affective, and pedagogical dimensions of these games.

The primary rationale for choosing a phenomenological design is the study's focus on the question, "How do pre-service teachers experience mind and intelligence games?" This question requires understanding the subjective meaning and context of the experience rather than measuring outcomes that can be quantified through a quantitative approach.

Participants

The participants consisted of 19 pre-service teachers who were studying at a faculty of education at a public university in Türkiye during the 2024–2025 academic year. Participants were selected through convenience sampling, and criterion sampling was used to ensure that all participants had prior experience with mind and intelligence games. The main selection criterion was that pre-service teachers had experience playing mind and intelligence games. Participants were informed about the study through an announcement made within the faculty, and those who volunteered to participate and met the selection criterion were included in the study.

Table 1

Demographic Characteristics of the Participants

Variable	Category	n	%
Gender	Female	9	47.4
	Male	10	52.6
Age	18-22	14	73.7
	23-28	5	26.3
Department	Elementary School Teaching	6	31.6
	Mathematics Teaching	6	31.6
	Preschool Teaching	3	15.8
	English Language Teaching	2	10.5
	Guidance and Psychological Counseling	2	10.5
Grade Level	4th Grade	13	68.4
	3rd Grade	4	21.1
	2nd Grade	2	10.5
Frequency of Playing Games	Occasionally	11	57.9
	Regularly	5	26.3
	Rarely	3	15.8
Duration of Playing Games	More than 3 Years	8	42.1
	1 to 3 Years	7	36.8
	Less than 1 Year	4	21.1

Note. The frequency of playing mind and intelligence games was categorized based on participants' self-reported playing habits: regularly (at least once a week), occasionally (a few times a month), and rarely (less than once a month).

As shown in Table 1, the gender distribution of the participants was relatively balanced, and most participants were between 18 and 22 years of age. Most participants (68.4%) were fourth-year students, indicating that the study was conducted with a group in the final stage of teacher education who are mature in terms of pedagogical formation and subject-matter knowledge. Although participants from different grade levels were included in the study, the higher proportion of fourth-year students may be related to the convenience sampling method and the experience criterion required for participation in mind and intelligence games. The fact that 84.2% of the participants occasionally or regularly play mind and intelligence games shows that the study group has sufficient experience related to the research topic.

Data Collection Tools

A semi-structured interview form developed by the researcher was used to collect data in this study. During the development process of the interview form, the relevant literature (Csikszentmihalyi, 1990; Diamond, 2013; Kiili, 2005; Qian & Clark, 2016) was reviewed, and a theoretical framework concerning the

cognitive, affective, and pedagogical dimensions of mind and intelligence games was established. Based on this framework, open-ended questions were prepared to enable participants to express their experiences, perceptions, and opinions in depth.

To ensure the content validity of the interview form, the draft was reviewed by two faculty members specializing in curriculum and instruction and one assistant professor in educational sciences. The experts evaluated the clarity, comprehensiveness, and alignment of the questions with the research purpose. After incorporating their suggestions, the form was finalized.

A pilot implementation of the interview form was conducted with three pre-service teachers who were not included in the main study group. The initial draft of the interview form consisted of ten questions. Following the pilot study, three questions were removed due to redundancy and lack of clarity, and the final version of the interview form consisted of seven open-ended questions. The main data collection process was carried out during the 2024–2025 academic year at a faculty of education in a public university in Türkiye. The interviews were conducted in a private setting within the faculty and lasted approximately 20–30 minutes for each participant.

The interview form consisted of two sections. The first section includes questions regarding participants' demographic information (gender, age, department, grade level) and their game-playing habits (frequency, duration, preferred game types). The second section contains seven open-ended questions addressing the sub-questions of the study. Ethical approval for this study was obtained from the Ethics Committee of Social and Human Sciences at Balıkesir University (Decision No: 2025/09-06, Date: 26.09.2025).

Data Analysis

The data obtained from the study were analyzed using the content analysis method, one of the qualitative research approaches (Miles et al., 2014). During this process, the participants' responses to open-ended questions were read repeatedly by the researchers, and meaningful statements were identified and coded.

In line with the phenomenological perspective, participants' statements were first examined to identify significant expressions related to their experiences with mind and intelligence games. These expressions were then grouped into meaning units and interpreted to reveal the shared meanings of the phenomenon.

The resulting codes were grouped into categories based on similar meanings, and overarching themes were developed from these categories. Based on these interpretations, thematic descriptions were developed to represent the essence of pre-service teachers' experiences with mind and intelligence games, while also considering variations in participants' lived experiences. The findings are presented with direct quotations from participants' statements, which contributes to the credibility of the study.

To enhance the trustworthiness of the study, several strategies were employed. Credibility was supported by providing detailed descriptions of the participants and the research process, as well as by including direct quotations from participants in the findings section. Transferability was strengthened by presenting detailed contextual information about the study group and research setting. Dependability was ensured by clearly describing the data collection and analysis procedures. The coding process followed the coding and categorization procedures suggested by Miles et al. (2014) and was conducted independently by the researchers. Inter-coder agreement was calculated using the procedure proposed by Miles et al. (2014), and the agreement level was found to be 0.92, indicating a high level of consistency between coders. Participants' quotations were labeled as PT1 (Pre-service Teacher 1).

Findings

In this section, pre-service teachers' responses to the interview questions are presented in a structured manner in line with the research objectives.

Reasons for Pre-service Teachers' Preference for Mind and Intelligence Games

To explore the reasons why pre-service teachers prefer mind and intelligence games, participants' responses were analyzed and grouped into themes, categories, and codes. The findings obtained from the content analysis are presented in Table 2.

Table 2

Reasons for Pre-service Teachers' Preference for Mind and Intelligence Games

Theme	Category	Code	f
Preference	Motivational	Interest	5
		Enjoyment	2
		Excitement	1
		Emotional Development	1
		Patience	1
		Curiosity	1
	Higher Order Thinking	Brain Exercise	5
		Ability to Look From Different Perspectives	3
		Creativity Development	2
		Problem-Solving Skill	2
		Reasoning	1
		Planning	1
		Ability to Make Quick Decisions	1
		Risk Management	1
		Multi-Step Thinking	1
		Critical	1
	Contextual	Strategy	1
		Assessment in the Teaching Process	1
		Competition	1
		Social Interaction	1

Based on these codings, the views of pre-service teachers on their reasons for preferring mind and intelligence games are grouped under the theme of "Preference" within the categories of "Motivational," "Higher-Order Thinking," and "Contextual." When examining responses related to the Motivational category, it was found that pre-service teachers mostly prefer mind and intelligence games due to factors such as interest, enjoyment, excitement, emotional development, curiosity, and patience. Findings related to the Higher Order Thinking category show that pre-service teachers prefer these games because they support brain exercise, creativity development, the ability to look from different perspectives, problem-solving, reasoning, planning, quick decision-making, risk management, multi-step thinking, and critical thinking skills. Within the Contextual category, it is determined that mind and intelligence games are preferred for their aspects of strategy development, ability to make assessments during the teaching process, supporting a sense of competition, and increasing social interaction.

Pre-service teachers reported various reasons for preferring mind and intelligence games, emphasizing motivational, cognitive, and contextual factors. Some participants highlighted that these games are appealing because they create excitement and make the activity more engaging compared to other types of games. This finding suggests that the attractiveness of mind and intelligence games is closely related to their ability to create an enjoyable and stimulating learning environment, which may enhance students' willingness to participate in learning activities. For instance, one participant stated that "*it creates more excitement compared to other types of games*" (PT3).

In addition to motivational aspects, participants also emphasized the cognitive benefits of mind and intelligence games. They indicated that these games encourage individuals to think from different perspectives and explore multiple solutions to a problem. Such experiences appear to support flexible thinking and problem-solving processes, which are often associated with higher-order thinking skills in learning environments. As one participant explained, "*it helps me think differently by showing that there is more than one way to solve a problem*" (PT6).

Furthermore, some participants pointed out the pedagogical value of these games in educational contexts. They expressed interest in examining and researching different mind and intelligence games in

order to use them in their future teaching practices. This suggests that pre-service teachers do not only perceive these games as recreational activities but also as potential instructional tools that can support teaching processes. For example, one participant stated that "*I research and examine these types of mind and intelligence games more to use them during my teaching*" (PT9).

Factors Influencing Pre-Service Teachers' Interest in Mind and Intelligence Games

In order to identify the factors that influenced pre-service teachers' inclination toward mind and intelligence games, participants' responses were analyzed through content analysis and grouped into themes, categories, and codes. The results of this analysis are presented in Table 3.

Table 3

Factors Influencing Pre-service Teachers' Interest in Mind and Intelligence Games

Theme	Category	Code	f
Interest	School-Based	Interest That Began at University	9
		Teacher Influence	6
		Interest That Began in Primary School	
		Interest That Began in Middle School	4
		Community Influence	3
		Interest That Began in High School	1
		Certificate Program	1
	Environment-Based	Friend's Recommendation	5
		Family Influence	3
		Individual Interest	2

The views of pre-service teachers on the factors influencing their interest in mind and intelligence games were grouped under the theme of "Interest," within the categories of "School-Based" and "Environment-Based." Responses related to the School-Based category showed that pre-service teachers' interest in mind and intelligence games mostly began during their university years. In addition, teacher influence, interest that began in primary school, middle school, and high school, and participation in certificate programs also supported this interest. Findings related to the Environment-Based category showed that friends' recommendations, family influence, and individual interest played significant roles in shaping pre-service teachers' interest in mind and intelligence games.

Pre-service teachers indicated that their interest in mind and intelligence games was influenced by various school-related and environmental factors. Several participants reported that their initial exposure to these games occurred during their educational experiences, particularly through school activities or institutional opportunities. This finding suggests that educational settings can play an important role in introducing and sustaining interest in mind and intelligence games among learners. For example, one participant explained that their interest began during their university years after encountering a student club related to mind and intelligence games, stating that "*in the first year of my university, I heard there was a Mind and Intelligence Games Club. The name caught my attention, and since then I have been interested*" (PT3).

In addition to school-based influences, participants also emphasized the role of their social environment in shaping their interest in these games. Some reported that friends played an important role in introducing them to mind and intelligence games. This indicates that peer interaction and informal social networks may contribute to the dissemination and popularity of such games among pre-service teachers. As one participant stated, "*I started based on a friend's recommendation*" (PT6).

Furthermore, early school experiences were also mentioned as influential factors in shaping participants' interest in mind and intelligence games. Exposure to these games during earlier stages of schooling appears to have created long-term interest and familiarity with such activities. One participant noted that their interest started during middle school through a school-based initiative, explaining that "*it started in the mind and intelligence games room opened by our guidance counselor in 8th grade*" (PT9).

Overall, these findings suggest that both institutional opportunities and social interactions play a significant role in shaping pre-service teachers' interest in mind and intelligence games.

Perceived Cognitive Contributions of Mind and Intelligence Games

To examine pre-service teachers' views on the cognitive contributions of mind and intelligence games, participants' responses were analyzed through content analysis and organized into themes, categories, and codes. The results obtained from this analysis are presented in Table 4.

Table 4

Pre-service Teachers' Views on the Contributions of Mind and Intelligence Games to Cognitive Skills

Theme	Category	Code	f
Cognitive	Thinking	Problem-Solving Skill	12
		Multidimensional Thinking	7
		Strategic Thinking	6
		Planning Skill	4
		Fast and Effective Thinking	3
		Analytical Thinking	2
		Decision-Making Skill	2
	Application	Mental Clarity	3
		Transfer to Daily Life	2
		Increase in Attention and Concentration	1

The views of pre-service teachers regarding the contributions of mind and intelligence games to cognitive skills have been grouped under the theme of "Cognitive," within the categories of "Thinking" and "Application." Responses related to the Thinking category indicate that pre-service teachers express that mind and intelligence games especially improve problem-solving skills, multidimensional and strategic thinking, planning, analytical thinking, fast and effective thinking, and decision-making skills. Findings related to the Application category reveal that mind and intelligence games support cognitive processes such as transfer to daily life, mental clarity, and increased attention and concentration.

Pre-service teachers emphasized that mind and intelligence games contribute to the development of various cognitive skills, particularly multidimensional thinking and strategic planning. Participants indicated that these games encourage individuals to approach problems from different perspectives and to evaluate alternative solutions. This finding suggests that such games may support flexible thinking processes by requiring players to analyze different possibilities and anticipate potential outcomes. For example, one participant stated that "*it plays an important role in developing different perspectives*" (PT4).

In addition to these cognitive processes, some participants highlighted that the skills developed during gameplay may also be transferred to real-life situations. Planning ahead and anticipating possible consequences during games appear to create opportunities for applying similar reasoning strategies in everyday decision-making contexts. As one participant explained, "*in games like chess, since we think and plan one or two moves ahead, this kind of planning is also applied in daily life*" (PT1).

Participants also noted that such games contribute to faster and more effective thinking processes. The time pressure and strategic demands of gameplay may require players to make quick yet reasoned decisions, which can strengthen mental flexibility and responsiveness. One participant expressed this view by stating that "*it contributes seriously to thinking, especially benefiting faster and more effective thinking styles*" (PT11).

Overall, these findings indicate that mind and intelligence games are perceived by pre-service teachers as activities that foster higher-order cognitive processes, including strategic thinking, planning, and flexible problem solving.

Perceived Affective Contributions of Mind and Intelligence Games

To explore pre-service teachers' views on the affective contributions of mind and intelligence games, participants' responses were analyzed using content analysis and organized into themes, categories, and codes. The findings obtained from this analysis are presented in Table 5.

Table 5

Pre-service Teachers' Opinions on the Contributions of Mind and Intelligence Games to Affective Skills

Theme	Category	Code	f
Affective	Individual	Fun	9
		Self-confidence	4
		Excitement	4
		Happiness	3
		Feeling of Comfort	3
	Interactional	Sense of Competition	10
		Socialization	7
		Empathy	5
		Cooperation	5

Pre-service teachers' views on the contributions of mind and intelligence games to affective skills were grouped under the theme of "Affective," within the categories of "Individual" and "Interactional." Responses related to the Individual category showed that pre-service teachers perceived mind and intelligence games as activities that foster fun, self-confidence, excitement, happiness, and a sense of comfort. Findings related to the Interactional category showed that these games encouraged socialization, enhanced cooperation, empathy, and a sense of competition.

Pre-service teachers reported that mind and intelligence games contribute to both individual and interactional affective experiences. At the individual level, participants emphasized that these games create feelings of excitement and increase self-confidence during gameplay. Such experiences may enhance learners' emotional engagement by allowing them to take responsibility for their decisions and observe the outcomes of their strategies. For instance, one participant stated that "*I play these mind and intelligence games in groups because they create extra excitement*" (PT2). Another participant highlighted the sense of personal responsibility and confidence developed through gameplay, explaining that "*you take full responsibility for your moves by focusing entirely on your own plan*" (PT8).

Participants also emphasized the interactional dimension of these games. Some indicated that the competitive nature of mind and intelligence games increases enjoyment and engagement in the activity. Competition appears to function as a motivating factor that stimulates participation and sustained attention during gameplay. As one participant expressed, "it feels more enjoyable because it increases competition" (PT9). In addition, participants noted that such games can also stimulate cognitive engagement during the activity, as players remain mentally active while responding to the moves of others. For example, one participant stated that "*it contributes seriously to thinking, especially benefiting faster and more effective thinking styles*" (PT11).

Overall, these findings suggest that mind and intelligence games create emotionally engaging learning environments by combining individual feelings of competence and responsibility with socially interactive elements such as competition and shared gameplay.

Challenges Experienced During Mind and Intelligence Game Play

To identify the challenges experienced by pre-service teachers during the process of playing mind and intelligence games, participants' responses were analyzed through content analysis and organized into themes, categories, and codes. The findings obtained from this analysis are presented in Table 6.

Table 6

Problems Faced by Pre-service Teachers During the Mind and Intelligence Games Playing Process

Theme	Category	Code	f
Challenges	Cognitive	Understanding Game Rules	6
		Complexity	5
		Need for Quick Decision-Making	3
		Focus	2
	Affective	Opponent Anxiety	3
		Failure	2
	Practical	Requirement for Repetition	2
		Access to Games	1

Pre-service teachers' views regarding the challenges encountered during the process of playing mind and intelligence games were grouped under the theme "Challenges" and categorized as cognitive, affective, and practical challenges. Responses related to cognitive challenges indicate that pre-service teachers experience difficulties such as understanding game rules, game complexity, the need for quick decision-making, and maintaining focus. Affective challenges include feelings of opponent anxiety and concerns about failure during gameplay. Practical challenges involve issues such as the need for repetition when learning games and limited access to game materials.

Pre-service teachers reported several challenges during the process of playing mind and intelligence games. Some of these challenges were related to cognitive demands, such as understanding game rules and managing complex strategies. Difficulties in interpreting rules or following the structure of certain games may create barriers for participants, particularly in group settings where multiple interactions occur simultaneously. For instance, one participant stated that "*I have difficulty in group games due to unclear rules*" (PT6). This finding suggests that the cognitive complexity of some games may initially hinder participation until players become familiar with the rules and strategies.

Participants also mentioned affective difficulties that emerged during gameplay. In particular, trying to anticipate opponents' strategies sometimes created feelings of anxiety and pressure. Such situations may arise because players are required to constantly predict others' moves while simultaneously planning their own strategies. As one participant explained, "*I struggle with guessing what the people opposite me are thinking and acting accordingly*" (PT3). This indicates that the competitive and strategic nature of these games can produce both cognitive challenge and emotional tension during gameplay.

In addition to cognitive and affective challenges, some participants pointed out practical limitations. For example, one pre-service teacher emphasized that access to game materials could be problematic, stating that "*because the games are expensive, purchasing games is a problem*" (PT10). Limited access to materials may restrict opportunities for regular gameplay and practice, which in turn may affect the continuity of engagement with mind and intelligence games.

Overall, these findings indicate that the challenges experienced during gameplay are multidimensional, involving cognitive, affective, and practical factors that may influence how pre-service teachers engage with mind and intelligence games.

Pre-service Teachers' Views on the Use of Mind and Intelligence Games as Instructional Materials

To explore pre-service teachers' opinions regarding the use of mind and intelligence games as instructional materials, participants' responses were analyzed through content analysis and organized into themes, categories, and codes. The findings obtained from this analysis are presented in Table 7.

Table 7

Pre-service Teachers' Opinions on the Use of Mind and Intelligence Games as Instructional Materials

Theme	Category	Code	f
Teaching	Emotional	Motivation	10
		Enjoyment	6
	Academic	Permanent Learning	7
		Cognitive Development	6
		Professional Integration	2

The opinions of pre-service teachers regarding the use of mind and intelligence games as instructional materials were gathered under the theme of "Teaching," within the categories of "Emotional" and "Academic." An analysis of the responses in the Emotional category revealed that pre-service teachers prefer to use mind and intelligence games as instructional materials because they increase student motivation and add an element of fun to the classroom environment. Findings related to the Academic category indicate that these games support the retention of learning, strengthen cognitive development, and contribute to the teaching process by facilitating professional integration.

Pre-service teachers emphasized that mind and intelligence games can be used as effective instructional materials that increase students' motivation and make learning more enjoyable. Participants suggested that these games can create an engaging classroom environment by transforming learning activities into interactive and enjoyable experiences. Such environments may encourage students to participate more actively in lessons and sustain their attention for longer periods. For example, one participant highlighted the enjoyable nature of these games by stating that "*it's a great way to have fun without technology, and since I have personally experienced their benefits, I would want my students to play as well*" (PT4).

In addition to their motivational value, participants also indicated that mind and intelligence games can support academic learning and improve the permanence of knowledge, particularly when teaching abstract subjects. The use of game-based materials may help make abstract concepts more concrete and understandable by allowing students to experience ideas through active participation. As one pre-service teacher explained, "*when teaching an abstract subject in mathematics, I would use materials like these games because they enhance retention*" (PT5). Similarly, another participant emphasized the motivational impact of these games by stating that "*these games increase motivation for learning*" (PT2).

Overall, these findings suggest that pre-service teachers perceive mind and intelligence games not only as entertaining activities but also as instructional tools that can support motivation, active participation, and meaningful learning in classroom settings.

Pre-service Teachers' Views on the Implementation of Mind and Intelligence Games in Classroom Settings

To examine pre-service teachers' opinions regarding the implementation of mind and intelligence games in classroom settings, participants' responses were analyzed through content analysis and organized into themes, categories, and codes. The findings obtained from this analysis are presented in Table 8.

Table 8

Opinions on the Effects and Challenges of Implementing Mind and Intelligence Games in the Classroom

Theme	Category	Code	f
Effect	Learning	Development of Problem-Solving Skills	6
		Increase in Concentration	4
	Affective	Socialization	5
		Enjoyment	5
	Implementation	Classroom Management	7
		Stress of Losing	4
		Accessibility Issue	3
		Student Differences	2

The opinions of pre-service teachers regarding the effects and potential challenges of implementing mind and intelligence games in the classroom were collected under the theme of 'Effect,' within the categories of 'Learning,' 'Affective,' and 'Implementation.' An analysis of responses in the Learning category revealed that pre-service teachers believe these games enhance problem-solving skills and increase students' concentration. Findings related to the Affective category indicate that the games support socialization and add an element of enjoyment to the classroom environment. Responses in the Implementation category address factors encountered during classroom application, such as classroom management challenges, stress related to losing, accessibility issues, and student differences.

Pre-service teachers emphasized that mind and intelligence games can contribute to students' cognitive and social development in classroom environments. Participants suggested that these games may support students' attention and concentration by creating interactive and engaging learning experiences. The structured nature of gameplay, which requires players to focus on rules, strategies, and outcomes, may help sustain students' cognitive engagement during lessons. For example, one participant noted that "*it is directly effective in terms of students' concentration in the lesson*" (PT3).

In addition to cognitive benefits, participants also highlighted the social contributions of these games. Gameplay often involves interaction, communication, and shared problem-solving, which may foster socialization among students and strengthen peer relationships in classroom settings. As one participant stated, "*it helps children socialize with one another*" (PT7).

However, some participants also pointed out potential challenges that may arise during classroom implementation. In particular, the competitive nature of certain games may lead to negative emotional reactions among younger students if the activity is not carefully structured. As one participant explained, "*another challenge is that students who lose at the elementary level may feel upset*" (PT10). This suggests that while mind and intelligence games may offer important pedagogical benefits, teachers need to manage competitive elements carefully and create supportive classroom environments during gameplay.

Overall, these findings indicate that the educational value of mind and intelligence games in classroom settings depends not only on the games themselves but also on how teachers structure and facilitate the learning process.

Discussion

This study examined pre-service teachers' experiences with mind and intelligence games using a phenomenological approach, revealing several important themes. The findings suggest that participants perceive that mind and intelligence games may enhance problem-solving, strategic thinking, and planning skills. This interpretation is consistent with previous research on chess education. For example, Blanch's (2022) meta-analysis reported improvements in problem-solving and reasoning skills associated with chess instruction. The current study suggests that similar cognitive benefits may also be perceived in other mind and intelligence games. Some participants reported that they were able to transfer the skills gained to daily life. However, previous large-scale studies have reported limited evidence for far transfer (Hampshire et al., 2019). This difference highlights the distinction between perceived transfer and empirically measured transfer. It remains unclear whether participants' subjective perceptions correspond to measurable

performance outcomes; therefore, these findings should be interpreted cautiously, considering possible influences such as social desirability or recall bias. Similarly, Sala and Gobet's (2016) meta-analysis reported limited transfer to academic achievement under certain conditions. These studies highlight the importance of examining the relationship between perceived cognitive benefits and measurable learning outcomes in future research.

Participant responses suggested that mind and intelligence games may support multidimensional thinking, strategic planning, and executive functions. This finding is consistent with Diamond's (2013) executive function theory, which defines executive functions in three core components: inhibitory control, working memory, and cognitive flexibility. The qualitative codes obtained in this study reflect all three components. Meta-analyses by Somaa et al. (2025) indicate that brain training games may improve cognitive functioning, processing speed, and working memory. Aliyari et al. (2021) reported that Sudoku and similar puzzle games may improve attention and focus. This aligns with the "increase in concentration" code identified in the current study and highlights the neuro-pedagogical significance of games in supporting prefrontal cortex functions. Similarly, studies conducted in the context of Türkiye also suggest that mind and intelligence games may contribute to the development of cognitive skills such as problem-solving, reasoning, and strategic thinking among learners and pre-service teachers (Kul & Kel, 2021; Güneş & Güneş, 2024).

A unique contribution of this study is that pre-service teachers perceived mind and intelligence games not only as tools for individual development but also as learning experiences that may enhance professional competencies. Participants' intention to integrate these games into future lessons under the theme of "teaching process assessment" aligns with Kiili's (2005) experiential gaming model, which emphasizes the challenge-skill balance, meaningful choices, and feedback loops in game-based learning. Research by Rodríguez-Ferrer et al. (2023) suggests that game-based learning may increase attention, satisfaction, and engagement in teacher education. The findings of the present study support these arguments by providing qualitative insights into pre-service teachers' experiences with mind and intelligence games. Similarly, Güneş (2025) reported that mind and intelligence games may strengthen problem-solving and strategic thinking skills, with game competitions potentially influencing motivation and participation. Güneş (2024) suggested that games may enhance attention, collaboration, and social interaction in classroom settings. Güneş and Güneş (2024) further demonstrated that pre-service teachers experience games as opportunities for both individual and professional development and intend to integrate them into lesson plans.

The motivational findings align with Csikszentmihalyi's (1990) flow theory. Participants' statements related to "enjoyment," "excitement," and "attention capture" reflect core components of the flow experience, including concentration, intrinsic motivation, and altered perception of time. According to Ryan and Deci's (2000) self-determination theory, satisfying the needs for autonomy, competence, and relatedness may support deep learning.

Affective contributions suggest that mind and intelligence games may be effective at both individual (self-confidence, enjoyment, excitement) and social (competition, collaboration, socialization) levels. Vygotsky's (1978) sociocultural theory emphasizes the central role of social interaction in learning. Interestingly, competition was perceived both as a source of motivation and stress. From the perspective of flow theory, competition may support learning when it maintains a balance between challenge and skill, whereas excessive competition may lead to anxiety and reduced performance. Zelazo et al. (2003) also highlight individual differences in executive function development in early childhood.

Qian and Clark (2016) noted that game-based learning enhances 21st-century skills such as problem-solving, critical thinking, creativity, and collaboration. The current study appears to confirm and extend these findings from the perspective of pre-service teachers. Participants indicated that mind and intelligence games may support not only cognitive skills but also social and affective competencies, such as empathy, collaboration, self-confidence, and emotional regulation, in line with 21st-century learning frameworks (P21, 2019).

In Türkiye, the implementation of the Ministry of National Education's Intelligence Games Module since 2012 has increased the visibility of mind and intelligence games in educational settings (MoNE, 2013). Participants emphasized school-related support factors, including teacher influence, elementary school

experience, and material accessibility. Challenges such as material access and time management reflect implementation difficulties also noted in official MoNE documents (MoNE, 2023).

In summary, the findings suggest that constructivist learning, executive functions, flow theory, and 21st-century skills frameworks are complementary. Pre-service teachers' experiences suggest that mind and intelligence games may be integrated into teacher education as a multidimensional pedagogical tool.

Recommendations for Practitioners

1. Teacher education programs may consider offering elective or mandatory courses in which mind and intelligence games are addressed both theoretically and practically. In these courses, pre-service teachers may actively engage in playing games and gain experience through classroom micro-teaching applications.

2. Since participants indicated that competition and emotional reactions may arise during gameplay, teachers may design learning environments that balance competition with collaboration. Such practices may help maintain students' motivation and create a supportive classroom atmosphere.

3. School administrations and policymakers may support the effective implementation of mind and intelligence games by providing material resources, appropriate physical spaces (e.g., "intelligence game rooms"), and in-service training programs.

Recommendations for Researchers

1. Since participants reported that mind and intelligence games improve cognitive skills such as problem-solving, strategic thinking, and planning, future research may employ experimental or quasi-experimental research designs to objectively examine the extent to which these games influence cognitive development in different educational contexts.

2. The findings indicate that mind and intelligence games generate both positive emotions (e.g., enjoyment, motivation) and challenges (e.g., stress related to competition and losing). Future research may explore how these affective experiences influence students' engagement, persistence, and learning outcomes in game-based learning environments.

3. Participants expressed strong intentions to use mind and intelligence games in their future teaching; however, they also reported challenges related to material accessibility and classroom management. Therefore, future studies may investigate how institutional resources, classroom conditions, and teacher training influence the effective integration of mind and intelligence games into instructional practices.

Conclusion

The main conclusion of this study is that pre-service teachers perceive mind and intelligence games as providing significant cognitive, affective, and pedagogical benefits. Participants reported improvements in problem-solving, strategic thinking, executive functions, concentration, motivation, and social-emotional skills. They also expressed the intention to apply these games in their future teaching practices, confirming the practical relevance of game-based learning in teacher education.

CRediT authorship contribution statement

A.M.G. and E.Y. conceptualized the study and designed the research. A.M.G. conducted the data collection and performed the qualitative analysis. E.Y. supervised the interpretation of the data and provided methodological guidance. Both authors contributed to the writing, review, and final approval of the manuscript.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics Approval and Consent to Participate

Ethical approval for the study and the data collection instruments was obtained from the Ethics Committee of Social and Human Sciences at Balıkesir University (Decision No: 2025/09-06, Date: 26.09.2025). Participants were informed about the purpose of the study, participation was voluntary, and confidentiality and anonymity were ensured throughout the research process.

Declaration of AI Usage Statement

The authors declare that generative artificial intelligence tools were used only for limited language editing and wording suggestions. In this study, ChatGPT (accessed on 20.10.2025; version: GPT-4) was used for language editing and phrasing support. All conceptualization, data collection, analysis, interpretation, and final writing decisions were carried out by the authors. The outputs obtained from AI tools were carefully reviewed in accordance with ethical and academic standards. AI tools are not credited as authors, and the authors are solely responsible for the content of the article.

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|Research Article / Araştırma Makalesi|

Formative Assessment Embedded Scientific Inquiry Practices: Changes in Pre-Service Science Teachers' Knowledge and Views

Biçimlendirici Değerlendirme ile Desteklenmiş Araştırma Sorgulama Uygulamaları: Fen Bilgisi Öğretmen Adaylarının Bilgi ve Görüşlerindeki Değişimler

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Keywords

Scientific inquiry

Formative assessment

Preservice science teachers

Abstract

Developing preservice teachers' scientific inquiry skills is an important goal of teacher education because these skills support critical thinking and problem solving. This study examined how a training program integrating formative assessment with scientific inquiry influenced preservice science teachers' knowledge of and views about scientific inquiry. A qualitative case study was conducted with 15 fourth-year preservice science teachers. Data were collected through the Scientific Inquiry Inventory (SII) (pre–post), the Views About Scientific Inquiry (VASI) questionnaire (Lederman et al., 2014), semi-structured interviews, and reflective journals. The intervention consisted of an 18-week training program including four inquiry-based activities integrating formative assessment. Descriptive analysis examined preservice teachers' knowledge and views, while content analysis was used for their opinions about the training. Results showed clear improvements in preservice teachers' knowledge of and views about scientific inquiry. Participants reported that integrating formative assessment within inquiry supported deeper understanding, student engagement, and lasting learning. However, some components, particularly research report writing, remained challenging. Integrating formative assessment with inquiry-based practices in teacher education can support preservice teachers' inquiry competencies. Structured feedback and reflection opportunities may further strengthen these skills.

Anahtar Sözcükler

Araştırma sorgulama yöntemi

Biçimlendirici değerlendirme

Fen bilgisi öğretmen adayları

Öz

Fen bilgisi öğretmen adaylarının araştırma sorgulama becerilerini geliştirmek öğretmen eğitimi açısından önemlidir; çünkü bu beceriler günümüzün bilimsel ve toplumsal sorunlarını ele alabilmek için gerekli olan eleştirel düşünme ve problem çözme yetilerini destekler. Bu çalışmanın amacı, biçimlendirici değerlendirmeyi içeren bir eğitim programı aracılığıyla fen bilgisi öğretmen adaylarının araştırma sorgulamaya ilişkin bilgi ve görüşlerini geliştirmektir. Araştırma, dördüncü sınıfta öğrenim gören 15 fen bilgisi öğretmen adayı ile yürütülen nitel bir durum çalışmasıdır. Veriler, Araştırma Sorgulama Envanteri (ön test–son test), Araştırma Sorgulama Görüşleri anketi (Lederman vd., 2014), yarı yapılandırılmış görüşmeler ve yansıtıcı günlükler aracılığıyla toplanmıştır. Uygulama süreci, biçimlendirici değerlendirmeyi içeren dört araştırma sorgulama etkinliğinden oluşan 18 haftalık bir eğitim programını kapsamaktadır. Öğretmen adaylarının araştırma sorgulamaya ilişkin bilgi ve görüşlerini incelemek için betimsel analiz; eğitime yönelik görüşlerini incelemek için içerik analizi kullanılmıştır. Bulgular, öğretmen adaylarının araştırma sorgulamaya ilişkin bilgi ve görüşlerinde dikkate değer gelişmeler olduğunu göstermiştir. Katılımcılar, biçimlendirici değerlendirme ile bütünleştirilen araştırma sorgulama etkinliklerinin derin öğrenmeyi, öğrenci katılımını ve kalıcı öğrenmeyi desteklediğini belirtmiştir. Bununla birlikte, araştırma raporu yazma gibi bazı bileşenlerin katılımcılar için zorlayıcı olmaya devam ettiği görülmüştür. Sonuçlar öğretmen eğitimi programlarında biçimlendirici değerlendirmenin araştırma sorgulama ile bütünleştirilmesinin öğretmen adaylarının araştırma sorgulama yeterliklerini destekleyebileceğini göstermektedir. Araştırma sorgulama etkinlikleri sırasında yapılandırılmış geri bildirim sağlanması ve yansıtma fırsatlarının sunulması bu becerileri daha da güçlendirebilir.

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Introduction

Science education aims to develop scientifically literate individuals who are able to understand the processes by which scientific knowledge is generated. In this context, scientific inquiry constitutes a fundamental component of science teaching and learning. Inquiry-based learning encourages students to ask questions, design investigations, collect and analyze data, and construct explanations based on evidence. Through these processes, learners actively engage in knowledge construction and develop higher-order thinking skills such as critical thinking and problem solving (Uum et al., 2016).

For inquiry-based instruction to be implemented effectively, teachers must possess a strong understanding of scientific inquiry and be able to guide students through the processes of questioning, investigation, and interpretation. Accordingly, teacher education programs are expected to provide preservice teachers with opportunities to experience and practice inquiry processes during their training (Plummer & Özçelik, 2015). Experiencing these processes allows preservice teachers to better understand how inquiry-based learning environments function and how such environments can be implemented in classroom practice.

In addition to understanding inquiry processes, preservice teachers must also develop an understanding of the Nature of Scientific Inquiry (NOSI). NOSI refers to the characteristics of scientific investigations and the ways in which scientific knowledge is generated and justified (Lederman et al., 2014). According to Lederman et al. (2014), scientific inquiry includes several key components such as investigations beginning with questions, the use of diverse methodological approaches, the possibility of obtaining different results even when similar methods are used, the distinction between data and evidence, and the requirement that explanations be consistent with empirical evidence.

Research indicates that teachers' and preservice teachers' understandings of scientific inquiry significantly influence their instructional practices (Lederman et al., 2014). Studies conducted with preservice teachers frequently report that their views about scientific inquiry are often categorized as naive or mixed, indicating incomplete or partially developed understandings of inquiry processes (Concannon et al., 2020; Penn & Ramnarain, 2021). Similarly, research conducted with both teachers and preservice teachers suggests that structured instructional interventions are necessary to improve their understanding of scientific inquiry (Al-Momani, 2019; Inel-Ekici & Ekici, 2021; Karışan et al., 2017; Lederman & Lederman, 2019). These findings highlight the importance of supporting the development of scientific inquiry competencies within teacher education programs.

Formative Assessment in Inquiry-Based Science Teaching

Effective inquiry-based science teaching requires assessment approaches that support learning throughout the instructional process. Formative assessment plays a critical role in this regard because it enables teachers to monitor students' understanding, provide feedback, and adjust instruction accordingly. Formative assessment refers to activities carried out by teachers and students that generate information used as feedback to modify teaching and learning processes (Black & Wiliam, 2006).

Through formative assessment practices, teachers collect evidence of students' learning, identify misconceptions, and design instructional responses that help students progress toward learning goals. This process involves clarifying learning objectives, eliciting evidence of student understanding, providing feedback, and supporting students in regulating their own learning (Moss & Brookhart, 2019; Stiggins, 2008). In science education, formative assessment practices are particularly valuable because inquiry-based learning environments require continuous monitoring of students' reasoning and investigative processes.

Educational policies also emphasize the importance of formative assessment. For example, the Turkish Science Curriculum highlights that assessment should focus not only on learning outcomes but also on learning processes, emphasizing continuous evaluation throughout instruction (Ministry of National Education, 2018, 2024). These policy documents underline the importance of integrating formative assessment practices into science teaching.

Integrating Formative Assessment and Scientific Inquiry

Recent research has increasingly explored the integration of formative assessment practices within inquiry-based science teaching. Studies have examined this integration from different perspectives, including its impact on students' academic achievement (Köksalan, 2019; Nishizuka, 2022), its role in the development of preservice teachers' pedagogical content knowledge (Talanquer et al., 2013; Vogt & Schmiemann, 2020), and its influence on teachers' beliefs and competencies (Chi et al., 2021). Research also indicates that formative assessment practices embedded in inquiry-based activities can improve students' conceptual understanding and engagement in learning processes (Arnold et al., 2018; Ruiz-Primo & Furtak, 2007).

Although previous studies demonstrate the potential benefits of combining formative assessment and scientific inquiry, most research has focused primarily on student learning outcomes or teachers' pedagogical knowledge. Comparatively fewer studies have explored how preservice teachers experience instructional processes in which formative assessment practices are systematically integrated into scientific inquiry activities within teacher education contexts. In particular, limited research has examined how preservice teachers' understandings of scientific inquiry develop while they actively engage in formative assessment-embedded inquiry practices over an extended instructional process. Addressing this gap may provide important insights for designing teacher education programs that aim to develop inquiry-oriented teaching competencies.

Purpose of the Study

Teacher education programs play a critical role in preparing future teachers to design inquiry-based learning environments and to use formative assessment effectively in science classrooms. Therefore, examining instructional processes that integrate formative assessment with scientific inquiry can provide valuable insights into how preservice teachers develop inquiry-related competencies.

This study investigates a teacher education process in which scientific inquiry training integrated with formative assessment was implemented with preservice science teachers. By examining preservice teachers' developing knowledge, views, and experiences throughout this instructional process, the study aims to contribute to the literature by providing a detailed account of how formative assessment-embedded inquiry practices function within teacher education.

Based on the theoretical background and the identified gap in the literature, the present study focuses on understanding both the development of preservice teachers' scientific inquiry understanding and their experiences during the formative assessment-embedded inquiry process implemented in teacher education.

This study addresses the following research questions:

1. How did preservice science teachers' knowledge of scientific inquiry develop during the formative assessment-embedded scientific inquiry training process?
2. How did preservice science teachers' views about scientific inquiry evolve throughout the formative assessment-embedded scientific inquiry training?
3. How did preservice science teachers experience the formative assessment-embedded scientific inquiry process, and what kinds of learning patterns emerged during this process.

Method

Research Design

This study employed a qualitative single case study design. Case studies aim to examine a phenomenon in depth within its real-life context by drawing on multiple sources of evidence (Merriam, 1998). In the present study, the case represents a teacher education process in which scientific inquiry training integrated with formative assessment was implemented with preservice science teachers. The study aimed to describe preservice science teachers' prior knowledge and views about scientific inquiry and to examine how these developed during the training process. In addition, the study explored participants' opinions regarding the integration of formative assessment and scientific inquiry.

Participants

The study group consisted of 15 fourth-year preservice science teachers enrolled in a science teacher education program at a public university in Türkiye. In Türkiye, science teacher education programs are typically four-year undergraduate programs designed to prepare preservice teachers to teach science at the middle school level. The program generally includes courses related to subject matter knowledge, pedagogical knowledge, and teaching practice. Throughout the program, preservice teachers take courses focusing on science content, teaching methods, classroom management, and assessment in education.

Participants in this study were selected through convenience sampling, as the research was conducted within the context of a course attended by the researcher's students. The preservice teachers shared several common characteristics: they had previously completed courses such as Principles and Methods of Instruction, Measurement and Evaluation, and Science Teaching I, but had not taken a course specifically focused on formative assessment. Among the participants, 14 were female and 1 was male. Ethical considerations were followed throughout the study. Gazi University Ethics committee approval was obtained (Approval No: 17311665-302.08.01-140496, dated 29.12.2020). Participants were informed about the purpose of the study and assured that their responses would be used solely for research purposes and would not affect their course grades. Participation was voluntary, and pseudonyms were assigned to protect participants' anonymity.

Data Collection Tools

This study employed multiple qualitative data collection tools to address its research objectives. To evaluate preservice teachers' knowledge of scientific inquiry implementation (Research Question 1), Scientific Inquiry Inventory (SII), a novel instrument developed for this investigation, was used. For examining their perspectives on scientific inquiry (Research Question 2), the Views About Scientific Inquiry (VASI) Questionnaire, originally developed by Lederman et al. (2014) and validated in Turkish by Karışan et al. (2017), was used. Research Question 3, focusing on the integration of formative assessment with scientific inquiry, was explored through semi-structured interviews. Additionally, the researcher maintained detailed reflective journals documenting participant progress, which informed the interpretation of results. Ethics Committee approval was obtained for this study. The following sections provide comprehensive descriptions of each instrument's development and implementation.

Scientific Inquiry Inventory (SII)

The Scientific Inquiry Inventory (SII) was developed to evaluate preservice science teachers' ability to apply the components of scientific inquiry when addressing scientific questions. Grounded in the framework proposed by Minner et al. (2010), the SII has five core components: posing questions, designing investigations, collecting data, drawing conclusions, and communicating findings. During its development, these stages were systematically defined, and questions were formulated based on both Minner et al.'s (2010) framework and a thorough review of relevant literature (Kruit et al., 2018; Lederman et al., 2014). To ensure content validity and reliability, a specifications table and rubric were created. These materials, along with the draft SII, underwent review by three scientific inquiry experts, whose feedback guided revisions before finalization. Sample questions are shown in Table 1.

Table 1

Sample Questions of SII

Case	Scientific Inquiry Components	Question
The science teacher assigned Ali a research project. He is supposed to investigate a phenomenon he is curious about in his surroundings, following the steps of the scientific inquiry method. Ali wants to research the effect of light intensity on the rate of photosynthesis in plants.	Formulating research questions	Write a research question suitable for this problem.
	Designing experiments	Design an experiment that could provide an answer to this research question.

In Table 1, sample questions of SII are shown. A total of 29 open-ended questions were prepared across six different scenarios to assess preservice teachers' ability to utilize the components of scientific inquiry. Based on the specification table, the distribution of the items across the inquiry components was as follows: posing questions (7 items), designing investigations (9 items), data-related processes including data collection and organization (5 items), drawing conclusions including data analysis and interpretation (5 items), and communicating findings through research report writing (1 item).

Views About Scientific Inquiry (VASI) Questionnaire

The Views About Scientific Inquiry (VASI) questionnaire, developed by Lederman et al. (2014) and adapted into Turkish by Karışan et al., (2017), was used to assess preservice science teachers' understanding of scientific inquiry. This validated instrument examines eight core aspects of scientific inquiry: (1) investigations begin with questions rather than necessarily testing hypotheses, (2) there is no single universal scientific method, (3) research questions guide the inquiry process, (4) identical procedures may yield different conclusions, (5) methodology influences outcomes, (6) conclusions must align with collected data, (7) data and evidence are distinct concepts, and (8) inferences integrate prior knowledge with empirical findings. To ensure coding reliability, an independent expert co-coder analyzed a portion of the data, resulting in an 89% inter-coder agreement rate, which demonstrates strong consistency in the qualitative analysis.

Interview Form

A semi-structured interview protocol was developed to gather preservice science teachers' opinions about the scientific inquiry training integrated with formative assessment. The initial interview form consisted of 12 questions. After being reviewed by two subject matter experts (SMEs), the questions were modified for clarity and relevance, and the final form included 10 questions. The final interview questions focused on four key areas: (1) teachers' opinions about designing inquiry-based lessons with formative assessments, (2) their positive and negative experiences with the approach, (3) their views on the method's practicality, and (4) their willingness to use it in future teaching. This expert validation process helped ensure the interview questions effectively captured teachers' opinions about the integrated teaching method.

Researcher's Journal

The researcher maintained a reflective journal throughout the training process. The journal included observations about classroom interactions, preservice teachers' participation levels, engagement in inquiry activities, responses to feedback, and reflections on the instructional process. In addition to documenting classroom events, the journal served as a tool for reflexivity, allowing the researcher to reflect on the instructional process and interpret preservice teachers' learning progress. These reflections supported the interpretation of changes observed in the SII and VASI findings.

Data Collection

Pre-test and Post-test Administration

The pre-test and post-test instruments were administered face-to-face during regular class sessions within the teacher education course in which the intervention was implemented. The pre-test was conducted before the beginning of the training process in order to determine preservice teachers' initial knowledge and views about scientific inquiry. The post-test was administered after the completion of the training. Both instruments were applied in the classroom environment, and participants completed the open-ended questions individually. Each administration took approximately one class period, and preservice teachers were given sufficient time to provide detailed responses.

Activity Development and Implementation Process

The study incorporated four scientific inquiry activities, each integrated with formative assessment components, designed for preservice teachers. These activities were developed using a research-based framework (Kruit et al., 2018; Lederman et al., 2014; Inaltun & Ateş, 2018; Minner et al., 2010) that systematically combines scientific inquiry stages with formative assessment strategies (detailed in Table 2). The activities addressed four key physical science concepts: (1) electrical conductivity, (2) density, (3) heat

transfer, and (4) germination, aligned with specific learning objectives established through researcher-expert collaboration. Prior to implementation, all activities underwent rigorous review by two field specialists to ensure their scientific and pedagogical validity. Table 2 shows the activity framework that explains how formative assessment is integrated into scientific inquiry practices.

Table 2

Activity Framework

SI and FA Components	Practices
Determining Learning Objectives and Success Criteria (Formative Assessment)	Learning objectives and success criteria are collaboratively established with students for a specific learning outcome aligned with the scientific inquiry method.
Obtaining Information About Student Learning (Formative Assessment)	Effective classroom dialogue is fostered. Students' readiness levels, scientific knowledge, misconceptions, incomplete knowledge, and common alternative conceptions are identified.
Instructional Decision Making (Formative Assessment)	If any misconceptions are present, move to the conceptual change texts. If not, move to the next step in lesson.
Providing Feedback (Formative Assessment)	Feedback is provided to students at every stage.
Questioning (Scientific Inquiry)	A research question is formulated. A hypothesis is established.
Designing (Scientific Inquiry)	Variables are identified. Operational definitions of variables are established. An experiment is designed.
Data (Scientific Inquiry)	Data are collected, organized, and analyzed.
Conclusions (Scientific Inquiry)	Conclusions are drawn.
Communication (Scientific Inquiry)	A research report is written.
Planning the Next Step (Formative Assessment)	The next instructional step is planned based on the data obtained from student learning.

Training Content

The 18-week training program commenced with a 7-week theoretical foundation on scientific inquiry and formative assessment, during which preservice teachers participated in four inquiry-based activities incorporating formative assessment. Throughout the training, they received weekly feedback. This article specifically examines three key outcomes of the training: preservice teachers' acquired knowledge of scientific inquiry, their evolving views on inquiry-based teaching, and their reflective evaluations of the training program's effectiveness.

Data Analysis

Analysis of Knowledge of Scientific Inquiry

Participants' responses to the Scientific Inquiry Inventory were evaluated using an analytic rubric developed for each component of scientific inquiry based on the relevant literature (Baykara, 2019; Ebenezer et al., 2011; Kruit et al., 2018; Lederman et al., 2014; Temiz, 2007). Each response was scored on a four-level scale (0 = unclear/blank, 1 = naïve, 2 = mixed, 3 = informed). These scores correspond to the categories used in the literature to describe levels of understanding of scientific inquiry (Lederman et al., 2014). After scoring each item, the scores obtained from the questions representing the same inquiry component were combined to determine participants' overall levels (informed, mixed, naïve, or unclear) for that component. This procedure enabled the systematic evaluation of open-ended responses while allowing the results to be presented through categorical distributions.

Preservice teachers' responses were evaluated using an analytic rubric developed for the Scientific Inquiry Inventory. Each item was scored on a scale from 0 to 3 according to the level of scientific inquiry understanding reflected in the response. To ensure reliability in the coding process, a portion of the responses was independently coded by a second researcher experienced in science education. Inter-coder agreement was calculated using the formula proposed by Miles and Huberman (1994), which defines

reliability as the ratio of agreements to the total number of agreements and disagreements. The agreement between coders was found to be 91%, indicating a high level of consistency in the coding process.

Analysis of Views About Scientific Inquiry

Preservice teachers' views on scientific inquiry were examined through descriptive analysis. Lederman et al. (2014) employed the categories "Informed," "Mixed," "Naïve," and "Unclear" to classify individuals' views concerning the components of scientific inquiry. An individual was classified as "informed" if their responses fully aligned with the target response for a specific component throughout the questionnaire; "mixed" if there was partial alignment or contradictory answers; "naïve" if the answers contradicted accepted views; and "unclear" if the answers were incomprehensible or irrelevant to the topic. For each stage, students' views were scored according to these categories by determining the highest and lowest points, with category scores assigned as 3 for "Informed," 2 for "Mixed," 1 for "Naïve," and 0 for "Unclear." Inter-coder agreement was calculated using the formula proposed by Miles and Huberman (1994), which defines reliability as the ratio of agreements to the total number of agreements and disagreements. The agreement between coders was found to be 89%, indicating a high level of consistency in the coding process.

Analysis of Views on the Training

Data pertaining to preservice science teachers' views on the scientific inquiry training integrated with formative assessment were analyzed using content analysis. The derived codes and categories were supported with examples from the literature.

Findings

Findings Related to Preservice Science Teachers' Knowledge of Scientific Inquiry

This section presents findings regarding preservice science teachers' knowledge of scientific inquiry based on the Scientific Inquiry Inventory (SII). Table 3 summarizes the distribution of participants across four levels of understanding (informed, mixed, naïve, and unclear) for each scientific inquiry component before and after the training.

Table 3

Changes in Preservice Science Teachers' Knowledge of Scientific Inquiry

SI Stages	Informed (f)/%		Mixed (f)/%		Naïve (f)/%		Unclear (f)/%	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Formulating research questions	5/33	12/80	7/47	3/20	3/20	0	0	0
Hypothesizing	3/20	11/73	6/40	4/27	6/40	0	0	0
Designing experiments	1/7	11/73	9/60	4/27	5/33	0	0	0
Identifying and controlling variables	5/33	12/80	6/40	3/20	4/27	0	0	0
Establishing operational definitions of variables	1/7	10/67	8/53	4/27	6/40	1/7	0	0
Collecting data	1/7	11/73	8/53	3/20	5/33	0	1/7	1/7
Organizing data	2/13	12/80	4/27	2/13	3/20	1/7	6/40	0
Analyzing data	0	9/60	4/27	2/13	6/40	3/20	5/33	1/7
Drawing conclusions	2/13	11/73	4/27	4/27	6/40	0	3/20	0
Writing a research report	0	0	0	7/47	4/27	4/27	11/73	4/27

Table 3 indicates a clear shift in preservice teachers' levels of understanding across most components of scientific inquiry following the formative assessment–embedded inquiry training. In general, the number

of participants categorized at the informed level increased considerably, while the proportions of mixed, naïve, and unclear responses decreased.

The most substantial improvements were observed in components related to formulating research questions, designing investigations, and identifying variables. For example, the proportion of preservice teachers demonstrating informed understanding in formulating research questions increased from 33% in the pre-test to 80% in the post-test. Similarly, informed responses for hypothesizing increased from 20% to 73%, and for designing experiments from 7% to 73%. These findings suggest that the inquiry activities helped participants better understand how scientific investigations are structured and how research questions guide the inquiry process.

Qualitative evidence from participants' responses also illustrates this development. For example, in the pre-test, participant DD responded to a scenario about investigating the effect of fuel additives on automobile efficiency by writing the following statement: "Observe the distance traveled and efficiency rating of five cars after adding varying amounts of a fuel additive to gasoline." This response was coded as naïve, as it presented a statement rather than a research question and included multiple dependent variables without clearly identifying the independent variable. However, in the post-test, the same participant formulated the following research question: "Does the amount of additive mixed into gasoline affect car efficiency?" This response was coded as informed, as it clearly defined the independent variable (additive amount) and the dependent variable (car efficiency), demonstrating a clearer understanding of how research questions should be structured in scientific inquiry.

Substantial improvements were also observed in components related to data organization and drawing conclusions. For instance, the proportion of informed responses for organizing data increased from 13% to 80%, while informed responses for drawing conclusions increased from 13% to 73%. These results suggest that preservice teachers developed a stronger understanding of how data should be interpreted and used to support scientific conclusions during the inquiry process.

However, development was more limited in the data analysis component. Although the number of informed responses increased from 0% to 60%, several participants still remained at the mixed or naïve levels after the training. This pattern suggests that interpreting data and drawing analytical conclusions may represent a more complex cognitive process that requires more sustained practice.

The research report writing stage showed the most limited improvement. No participants reached the informed level either before or after the training. Nevertheless, a positive shift was observed in that the number of unclear responses decreased substantially, while several participants moved to the mixed level. This suggests that although participants began to develop an emerging understanding of research reporting, they still experienced difficulties articulating inquiry findings in a formal written format.

Overall, the findings indicate that the formative assessment–embedded inquiry activities contributed to a meaningful development in preservice teachers' knowledge of scientific inquiry, particularly in the early and middle stages of the inquiry process such as question formulation, experimental design, and variable identification.

Findings Related to Preservice Science Teachers' Views About Scientific Inquiry

Findings regarding preservice teachers' views about scientific inquiry were obtained through the Views About Scientific Inquiry (VASI) questionnaire. Table 4 presents the distribution of participants' views across the categories of informed, mixed, naïve, and unclear before and after the training.

Table 4

Changes in Preservice Science Teachers' Views About Scientific Inquiry

VASI Components	Informed (f)		Mixed (f)		Naïve (f)		Unclear (f)	
	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test	Pre-test	Post-test
Component 1. Scientific investigations all begin with a question and and do not always test a hypothesis	4/27	12/80	11/73	3/20	0	0	0	0
Component 2. There is no single scientific path/method followed in all investigations	3/20	11/73	5/33	4/27	7/47	0	0	0
Component 3. The question asked guides the scientific inquiry process	7/47	12/80	4/27	1/7	4/27	2/13	0	0
Component 4. Scientists applying the same procedure may not reach the same conclusions	2/13	12/80	10/67	3/20	2/13	0	1/7	0
Component 5. The inquiry process affects results	1/7	7/47	8/53	8/53	5/33	0	1/7	0
Component 6. Research findings must be consistent with collected data	3/20	10/67	12/80	5/33	0	0	0	0
Component 7. Scientific data and scientific evidence are not the same thing	1/7	9/60	9/60	5/33	5/33	1/7	0	0
Component 8. Inferences are based on prior knowledge and collected data	1/7	13/87	12/80	2/13	2/13	0	0	0

The results demonstrate a noticeable shift toward more informed views of scientific inquiry following the training process. The most significant improvement was observed in the component stating that scientific inferences are based on prior knowledge and collected data. In this component, the proportion of preservice teachers categorized as informed increased from 7% in the pre-test to 87% in the post-test, representing the highest level of improvement among all components.

Another substantial improvement occurred in the component indicating that scientists applying the same procedure may reach different conclusions. Informed responses increased from 13% to 80%, while naïve responses were eliminated after the training. This shift suggests that preservice teachers developed a deeper understanding of the interpretive nature of scientific reasoning.

A similar pattern was observed for the component stating that scientific investigations begin with questions rather than necessarily testing hypotheses, where informed responses increased from 27% to 80%. These findings indicate that participants gained a clearer understanding of the diversity of inquiry approaches in scientific practice.

Qualitative responses from participants also illustrate this conceptual development. For example, when asked whether multiple scientists would reach the same conclusions if they used identical methods, participant ZNK initially responded: "Most would, but experimental errors may occur." This response was coded as naïve, as it attributed differences in conclusions solely to experimental error. In the post-test, the same participant responded: "No, because scientists may interpret data differently depending on their perspectives, experiences, and prior knowledge." This response was coded as informed, as it acknowledges the interpretive role of scientists in drawing conclusions from data.

Moderate development was observed in components such as "the inquiry process affects results" and "scientific data and scientific evidence are not the same thing." Although the proportion of informed responses increased in these areas, a notable number of participants remained at the mixed level, suggesting partial but incomplete conceptual change.

Overall, the findings indicate that the training helped preservice teachers move toward more sophisticated views of scientific inquiry, particularly regarding the role of research questions, the diversity of scientific methods, and the interpretive nature of scientific reasoning.

Findings Related to Preservice Science Teachers' Views on Training Integrated with Formative Assessment and Scientific Inquiry

Preservice teachers' views regarding the integration of formative assessment and scientific inquiry were analyzed through content analysis of the interview data. Three main themes emerged from the analysis: (1) perspectives on scientific inquiry, (2) contributions to student learning, and (3) future applications of the approach. Table 5 presents the themes, subthemes, and representative participant statements.

Table 5

Content Analysis Table

Theme	Sub-Theme	Definition	Example Quote	Notes/Comments
Perspective on Scientific Inquiry	Way of Thinking	Expresses the view that scientific inquiry is a way of thinking because it is used in daily life.	"I think it's a way of thinking because we use it in daily life as well."	Includes a different emphasis from the majority.
	Research Method	Expresses the view that scientific inquiry is a research method because it involves following specific steps, similar to how scientists conduct research.	"I think it's more of a research method because its steps guide scientists." (MK)	
	Both Method and Way of Thinking	Expresses the view that it can be considered both a way of thinking and a research method.	"Half and half, I think... I'm probably closer to it being a way of thinking." (EE)	Closer to the view of it being a way of thinking.
Contribution to Student Learning	Permanent Learning	Expresses the view that permanent learning is achieved by providing students with hands-on learning opportunities and connecting concepts to daily life.	"First of all, when a student learns by doing themselves, they reach a conclusion through experimentation with cause-and-effect relationships, and it stays in their mind more..." (HNİ) "...connecting it to daily life makes it concrete and is important for permanence." (HNİ)	
	Meaningful Learning	Expresses views that the integration of scientific inquiry and formative assessment makes learning more meaningful.	"we achieve meaningful learning through the activity." (AK) "It helps to arouse curiosity and learn the topic meaningfully." (AD)	Emphasized by all participants.
	Active Student Engagement	Expresses views that this integration encourages student participation and active involvement in class.	"I think it's very advantageous because it involves the student in the lesson and keeps them active..." (AD)	Includes an emphasis on student-centered instruction.
	Grabbing Attention	Expresses the view that starting with a problem situation motivates students and captures their attention.	"Starting with a problem situation motivates students and grabs attention, ensuring effective and permanent learning." (AK)	Includes comments related to the introductory phase of the lesson.
	Arousing Curiosity	Expresses the view that this integration arouses students' curiosity about the topic.	"Arousing curiosity, making them think..." (AK)	Emphasized by all participants.
	Cause-and-Effect Relationship	Expresses the view that conducting experiments helps students develop cause-and-effect reasoning.	"...when they reach a conclusion through experimentation with cause-and-effect relationships, it stays in their mind more..." (HNİ)	
	Problem Solving	Expresses the view that identifying a problem situation contributes to discovering the problem and generating solutions.	"...when identifying a problem situation, they discover the problem and try to find a solution themselves..." (HNİ)	
	Teaching Scientific Thinking	Expresses the view that this integration develops scientific thinking skills, similar to those of scientists.	"It teaches them to think like a scientist." (AD)	

Theme	Sub-Theme	Definition	Example Quote	Notes/Comments
Future Applications	To Make It Interesting	Expresses the desire to use this method in the future because of its engaging nature.	"Our lessons were generally monotonous... that's why I would use it. I think grabbing attention is beneficial." (AK)	Emphasizes the pedagogical rationale of the method.
	To Develop Scientific Thinking Skills	Expresses the reason for using this method in the future as engaging students in the lesson and developing their thinking skills.	"Yes, absolutely. To engage students in the lesson, to develop their thinking skills." (SG)	Emphasizes the pedagogical rationale of the method.
	Learning Outcomes Alignment	Expresses the reason for using this method in the future as its alignment with curriculum learning outcomes.	"Yes, I'm considering it. Because it's a comprehensive plan, especially for science, that can deliver the learning outcomes in the most accurate way." (HNİ)	Emphasizes the pedagogical benefit of the method.
	Efficiency	Expresses the view that conducting experiments, identifying problem situations, and classroom dialogue are efficient components of the method.	"The experiment part, the problem situation, classroom dialogue are very important in my opinion, it would be quite efficient." (HNİ)	Emphasizes the elements of the method.
	Applicability Doubt	Contains views expressing uncertainty about the adaptability of this integration to every topic and its suitability for every age group.	"I don't know if it can be adapted to every topic, and I'm not sure if it's suitable for every age." (EE)	Undecided about implementing this method in the future.
	Misconception Uncertainty	Expresses doubts about whether student misconceptions might arise.	"I also don't know if misconceptions will occur." (EE)	Undecided about implementing this method in the future.

Perspectives on Scientific Inquiry

Participants expressed different perspectives regarding the nature of scientific inquiry. A majority of preservice teachers described scientific inquiry primarily as a research method, emphasizing its structured stages and systematic procedures (n = 11). Participant MK explained: “I think it is more of a research method because its steps guide scientists.” Some participants, however, emphasized the cognitive dimension of inquiry and described it as a way of thinking (n= 3). Participant HNİ stated: “I think it is a way of thinking because we use it in daily life as well.”

Participant EE expressed a hybrid perspective, suggesting that inquiry could be understood as both a research method and a way of thinking: “Half and half, I think… I am probably closer to it being a way of thinking.”

These responses suggest that preservice teachers conceptualized scientific inquiry in multiple ways, reflecting both procedural and epistemological understandings.

Contributions to Student Learning

Participants widely emphasized the educational benefits of integrating scientific inquiry with formative assessment. The most frequently mentioned contribution was meaningful learning, which was highlighted by nearly all participants. Participant AK explained: “We achieve meaningful learning through the activity because students actively explore the topic.”

Many preservice teachers also emphasized the role of inquiry activities in promoting long-term retention. According to participant HNİ: “When students learn by doing the experiment themselves and see the cause-and-effect relationship, it stays in their minds longer.”

Another commonly mentioned benefit was increased student engagement. Participants indicated that problem situations and inquiry-based activities encouraged students to participate actively in the lesson. Participant AD: “I think it is very advantageous because it involves the student in the lesson and keeps them active.”

Participants also noted that the approach helped develop scientific thinking skills, enabling students to approach problems similarly to scientists. Participant AD: “It teaches them to think like a scientist.”

These statements suggest that preservice teachers perceived the integration of formative assessment and inquiry not only as an instructional method but also as a way to foster deeper conceptual engagement.

Future Applications

Most preservice teachers indicated that they would consider using this approach in their future teaching practices (n = 13). Participants reported that the method could make lessons more engaging and help students better understand scientific concepts. For example, Participant AK stated: “Our lessons are often monotonous, but this approach attracts students’ attention and makes the lesson more interesting.”

Participant SG emphasized the role of the approach in developing students’ thinking skills: “Yes, I would definitely use it. It helps students participate in the lesson and develop their thinking skills.”

However, a small number of participants expressed concerns regarding practical implementation. Some questioned whether the approach could be applied to every topic or grade level. For example, participant EE stated: “I do not know if it can be adapted to every topic, and I am not sure if it would work for every age group.” These comments suggest that while preservice teachers generally perceived the integration of formative assessment and scientific inquiry positively, some participants still had reservations regarding its classroom feasibility.

Overall, the findings indicate that preservice teachers largely viewed the integration of formative assessment and scientific inquiry as an effective instructional approach that can promote meaningful learning, student engagement, and scientific thinking.

Discussion

Preservice Science Teachers' Knowledge of Scientific Inquiry

Beyond the observed improvements in preservice teachers’ knowledge and views about scientific inquiry, the training process revealed important learning dynamics consistent with a case study perspective. The formative assessment–embedded inquiry activities created an instructional environment in which preservice teachers repeatedly engaged in cycles of planning investigations, generating evidence, receiving feedback, and revising their explanations. Researcher journal notes indicated that many participants initially approached inquiry activities primarily as procedural tasks. However, as the training progressed, classroom dialogue and feedback processes increasingly encouraged participants to justify their reasoning and reconsider their explanations in light of experimental evidence and peer discussion. These observations suggest that the intervention functioned not only as an instructional program but also as a developmental learning process in which preservice teachers gradually reconstructed their understanding of scientific inquiry.

An examination of preservice science teachers' performance across the stages of the scientific inquiry process—including question formulation, hypothesizing, experimental design, variable definition, data collection and analysis, drawing conclusions, and report writing—revealed an overall improvement following the training. These findings align with previous studies indicating that applied inquiry-based instruction can support the development of inquiry-related competencies among preservice teachers (İnel-Ekici & Ekici, 2021). In particular, the improvements observed in formulating research questions, constructing hypotheses, and designing investigations suggest that explicit instruction combined with structured feedback can effectively support preservice teachers in planning scientific investigations.

However, development across inquiry components was not uniform. Earlier interpretations attributed limited progress primarily to irregular participation in feedback sessions. Although participation patterns may have influenced individual performance, the present findings suggest that conceptual challenges inherent in certain inquiry components also played a role. Inquiry tasks such as defining operational variables or interpreting data require the coordination of multiple cognitive processes, including translating conceptual ideas into measurable indicators, analyzing empirical evidence, and connecting findings with theoretical

explanations. These cognitive demands may explain why some preservice teachers continued to experience difficulties even when they participated consistently in the training.

The operational definition of variables is widely recognized as one of the most challenging aspects of scientific inquiry (Ateş, 2005), and the findings of this study support this observation. Although many preservice teachers improved in this stage, several remained at mixed or naïve levels. Researcher journal notes suggested that these difficulties were often associated with incomplete explanations of how variables would be measured or controlled. Similar challenges in defining variables and designing investigations have also been reported in previous studies examining inquiry skills development among preservice teachers (Yoon et al., 2012).

Similarly, although substantial improvement was observed in data collection and organization, some participants experienced difficulties during the data analysis stage. Interpreting experimental data requires both analytical reasoning and the ability to connect results to conceptual explanations. While many preservice teachers progressed from descriptive observations toward explanatory interpretations, others struggled to integrate empirical findings with theoretical reasoning. These difficulties are consistent with earlier research indicating that learners often experience challenges when linking experimental data with theoretical interpretations (Chang et al., 2010).

The weakest performance was observed in the research report writing stage, where none of the participants reached the informed level after the training. This finding suggests that scientific communication represents an additional challenge for preservice teachers developing inquiry competencies. Writing a research report requires organizing evidence, articulating reasoning, and presenting conclusions within a coherent explanatory structure. For preservice teachers who are still developing inquiry skills, translating experimental experiences into structured scientific arguments may represent a cognitively demanding task. This finding highlights the importance of integrating explicit support for scientific writing and argumentation within inquiry-based teacher education programs.

Overall, the findings suggest that integrating formative assessment practices within inquiry-based instruction supports preservice teachers' learning not only by improving their procedural understanding of scientific inquiry but also by engaging them in iterative cycles of evidence generation, feedback, and explanation revision. Through this process, preservice teachers gradually shifted from viewing inquiry primarily as a sequence of steps toward understanding it as a reasoning process that requires interpreting evidence and justifying conclusions.

Preservice Science Teachers' Views About Scientific Inquiry

Changes in preservice teachers' views about scientific inquiry can be interpreted in relation to the learning processes experienced during the training. Before the intervention, preservice teachers generally demonstrated mixed views about scientific inquiry, a finding consistent with previous research involving both in-service and preservice teachers (Karışan et al., 2017; Valente et al., 2022). Following the training, a noticeable improvement was observed across several components of scientific inquiry understanding. One of the most significant developments occurred in the component stating that scientific inferences are based on prior knowledge and collected data. This development can be interpreted in relation to the formative assessment practices embedded in the training. By eliciting preservice teachers' prior ideas at the beginning of inquiry activities, formative assessment created opportunities for participants to compare their initial explanations with the evidence generated during investigations. Classroom dialogue and feedback processes encouraged preservice teachers to justify their conclusions and reconsider their reasoning. Through this process, participants increasingly recognized that scientific inferences emerge from the interaction between empirical data and prior conceptual understanding. These findings are consistent with previous studies suggesting that inquiry-supported instructional environments can promote deeper understanding of scientific inquiry concepts (Ünlü, 2021).

Substantial development was also observed in components related to the nature of scientific inquiry, including the understanding that scientists applying the same procedures may reach different conclusions and that scientific investigations do not always follow a single universal method. These improvements suggest that preservice teachers began to perceive inquiry as a flexible and interpretive process rather than

as a rigid sequence of steps. Such shifts align with contemporary perspectives on the nature of science emphasizing the interpretive, creative, and socio-cognitive aspects of scientific knowledge production (Lederman, 2004; Hodson, 1996; Vygotsky, 1978). Similar developments in preservice teachers' understanding of scientific inquiry have been reported in previous studies (Çiğdemoğlu-Köseoğlu, 2019; Ünlü, 2021).

Nevertheless, development across components remained uneven. For example, the component stating that research questions guide the inquiry process showed relatively limited change for some participants. This result suggests that certain aspects of scientific inquiry understanding may require more sustained conceptual engagement and repeated opportunities for explanation and reflection. Similarly, although many preservice teachers improved in distinguishing between scientific data and scientific evidence, some participants continued to demonstrate partial understandings. Distinguishing between these concepts requires recognizing that evidence involves interpreting data in relation to scientific claims, a reasoning process that may require extended practice.

These findings also contribute to the literature by illustrating how formative assessment practices may support the development of epistemic understanding in inquiry learning environments. By making preservice teachers' initial ideas visible and subject to discussion, formative assessment created opportunities for participants to examine how scientific explanations are constructed through the interaction of prior knowledge and empirical evidence.

In conclusion, the integration of formative assessment with scientific inquiry training effectively enhanced most preservice teachers' understanding of scientific inquiry, supporting existing literature on the value of structured, applied professional development (Arnold et al., 2018). The practical orientation of the intervention aligned with Karaman's (2007) recommendation that teachers need both conceptual understanding and authentic inquiry experiences. While significant progress was observed, persistent gaps in specific components suggest the need for more robust teacher education approaches featuring three key elements: (1) enhanced practical applications, (2) guided reflection opportunities, and (3) targeted individualized feedback to address remaining misconceptions and proficiency variations.

Preservice Science Teachers' Opinions Regarding Training in Formative Assessment and Scientific Inquiry Integration

This section analyzes preservice science teachers' opinions on the integrated formative assessment and scientific inquiry training, exploring three key dimensions: (1) their evaluation of the inquiry method itself, (2) perceived benefits for student learning, and (3) anticipated implementation challenges and opportunities in future practice. These qualitative insights address the study's final research question through in-depth interviews examining both the theoretical and practical aspects of the integrated approach. Under the theme Perspective on Scientific Inquiry, the finding that most preservice teachers perceive scientific inquiry as a "research method" with specific steps aligns with Bybee's (2006) emphasis on scientific inquiry in the science education literature concerning the teaching of scientific process skills. This perspective suggests that the scientific inquiry method offers students the opportunity to experience how scientists think and conduct science. Conversely, some preservice science teachers describing scientific inquiry as a "way of thinking," and one participant suggesting it could be a synthesis of both, reflects the diverse viewpoints in the literature. For instance, Lederman (2004) underscores the importance of internalizing science as a way of thinking by emphasizing that science is a flexible and creative process. Similarly, Hodson (1996) highlights the importance of students embracing scientific inquiry not merely as a method but as a cognitive framework that includes critical thinking and problem-solving processes. These findings, supported by the literature, indicate that both the methodological and the cognitive and structural aspects of scientific inquiry should be considered when training teachers.

Analysis of preservice teachers' reflections reveals unanimous agreement on the educational value of this integrated approach, particularly its effectiveness in promoting deep, lasting learning through authentic applications. These outcomes substantiate established learning theories, including Dewey's (1910) principles of experiential education and Piaget's (1972) constructivist framework, while also validating contemporary science standards (National Research Council [NRC], 2014). The observed development of scientific reasoning

skills and conceptual understanding through inquiry-based methods corroborates existing research (Arnold et al., 2018), with Köksalan's (2019) findings specifically confirming the synergistic benefits of combining formative assessment with inquiry-based instruction to enhance conceptual mastery through structured feedback mechanisms. Similarly, this study's findings align with established research, showing the integrated approach enhances engagement through active learning and curiosity-driven instruction while developing scientific reasoning and literacy (Al-Momani, 2019; Crawford, 2007). The results particularly support Ruiz-Primo and Furtak's (2007) findings that formative assessment during inquiry deepens learning and scientific thinking, confirming preservice teachers' recognition of this method's value in creating authentic, cognitively engaging science learning experiences. Finally, examining the Future Applications theme, it was determined that the majority of preservice science teachers exhibited a positive attitude toward incorporating this method into their future lesson plans. Among the most frequently cited justifications for this positive attitude were making lessons engaging, developing students' scientific thinking skills, and alignment with curriculum learning outcomes. These results indicate that preservice teachers wish to utilize the knowledge and experiences gained in their faculties of education once they become teachers. However, the hesitation expressed by two preservice teachers regarding the method's applicability and uncertainty about misconceptions aligns with some difficulties mentioned in the literature. Studies in the literature reveal that challenges teachers face include time constraints, misconceptions, student characteristics, and insufficient materials (Crawford, 2007). Additionally, studies emphasize that not every learning outcome in the curriculum may be suitable for scientific inquiry-based instruction and that students' pre-existing misconceptions need to be managed (Pozo & Gomez Crespo, 2005). Considering these factors, it is believed that teacher education needs to provide more practical experience and studies on adaptability to different classroom conditions. In conclusion, preservice teachers were found to be open to innovative science teaching approaches and willing to adopt strategies that promote more active, meaningful, and permanent student learning. This is a significant indicator that the future of science education will be student-centered and based on a scientific inquiry understanding (NRC, 2014).

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the study was conducted with a relatively small group of preservice science teachers enrolled in a single teacher education program. Therefore, the findings should be interpreted within the context of this specific group and may not be generalized to all preservice teachers. Second, the study focused on a particular instructional intervention implemented within a single course. Although the 18-week training process provided rich insights into preservice teachers' development, different implementations in other contexts or teacher education programs may lead to different outcomes. Finally, the data were collected primarily through written responses and interviews. Although these instruments provided valuable information about preservice teachers' knowledge and views about scientific inquiry, future studies could benefit from incorporating additional data sources such as classroom observations or teaching practices to gain a more comprehensive understanding of preservice teachers' inquiry skills.

Recommendations

There are some recommendations based on the findings of this research. Future research could explore the combination of different assessment methods with various teaching approaches, investigating their effects on diverse student variables. Given the identified importance of the feedback process, it's recommended that participants receive detailed training specifically focused on developing their feedback skills. Since preservice teachers reported significant difficulties with formulating problem situations, operationally defining variables, and writing research reports, it's recommended that detailed studies be planned to investigate and address these specific areas. Preservice teachers should be offered courses that integrate formative assessment with various teaching methods as they prepare for their profession. In this study, a step-by-step feedback process was conducted with each preservice teacher from the beginning of the training, with the researcher playing an active role in assisting them throughout the process. It's recommended that in future implementations, teachers actively participate in providing feedback.

Conclusion

This study examined the development of preservice science teachers' knowledge of and views about scientific inquiry within a formative assessment–embedded inquiry training process. The findings suggest that integrating formative assessment practices into inquiry-based instruction can support the development of inquiry-related competencies in teacher education contexts. Preservice teachers demonstrated improvements in several components of scientific inquiry, particularly in formulating research questions, designing investigations, and identifying variables. However, development was less evident in more complex components such as data analysis and research report writing, indicating that these areas may require more sustained instructional support and practice. In addition, participants' views about scientific inquiry showed a shift toward more informed understandings, especially regarding the role of prior knowledge in shaping inferences and the interpretive nature of inquiry processes. These changes may be associated with the opportunities for feedback, reflection, and classroom dialogue provided through formative assessment practices. Participants also reported that the integration of formative assessment and inquiry contributed to meaningful learning and increased engagement. Nevertheless, some concerns regarding the applicability of this approach across different topics and contexts highlight the need for further practice-oriented experiences in teacher education programs.

Author's Note

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CRediT authorship contribution statement

Elif Yalvaç Ertuğrul: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. Salih Ateş: Supervision, Methodology, Validation, Writing – review & editing.

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Declaration of AI Usage Statement

AI-assisted tools (Chat GPT 5.2, Google AI Studio) were used only for language editing and improving the clarity of the manuscript. The authors take full responsibility for the content of the article.

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|Research Article / Araştırma Makalesi|

Determinants of Higher Education Students' Use of Generative AI Chatbots: An Extended Technology Acceptance Model (TAM) Perspective

Yüksek Öğretim Öğrencilerinin Üretken Yapay Zekâ Sohbet Robotlarını Kullanımının Belirleyicileri: Genişletilmiş Teknoloji Kabul Modeli (TKM) Bakış Açısı

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Keywords

Generative artificial intelligence (Gen-AI)

Technology acceptance model (TAM)

Trust

Individual impact

Higher education

Abstract

This study investigates the factors influencing higher education students' self-reported use of generative AI (Gen-AI) chatbots through an extended Technology Acceptance Model (TAM). The model incorporates trust and individual impact alongside perceived usefulness and perceived ease of use to better explain students' adoption behavior. Usage is defined as the self-reported frequency of chatbot use rather than post-adoption continuance intention. A quantitative, cross-sectional survey was conducted with 303 higher education students. Data were analyzed using Structural Equation Modeling (SEM) in Smart-PLS after confirming the reliability and validity of the measurement model. It's shown that perceived ease-of-use significantly affects both perceived usefulness and self-reported usage. Perceived usefulness also positively influences usage frequency. Trust shapes students' perceptions of ease of use and usefulness but does not directly affect usage. Moreover, usage has a strong positive impact on individual outcomes, indicating academic and personal benefits associated with frequent use. Ease of use and perceived usefulness are the key drivers of students' Gen-AI use. Trust influences adoption indirectly by shaping these perceptions. Sustained use of these tools enhances academic and personal outcomes, and the extended TAM proves to be a suitable framework for explaining Gen-AI adoption in higher education contexts.

Anahtar Sözcükler

Üretken yapay zekâ

Teknoloji kabul modeli (TKM)

Güven

Bireysel etki

Yüksek öğretim

Öz

Bu çalışma, genişletilmiş bir Teknoloji Kabul Modeli (TKM) aracılığıyla, yükseköğretim öğrencilerinin üretken yapay zekâ (Gen-AI) sohbet robotlarını kendi bildirimlerine göre kullanmalarını etkileyen etmenleri araştırmaktadır. Model, öğrencilerin benimseme davranışlarını daha iyi açıklamak için algılanan yarar ve algılanan kullanım kolaylığının yanı sıra güven ve bireysel etkiyi de içermektedir. Kullanım, benimseme sonrası devam etme niyeti yerine, sohbet robotu kullanımının kendi bildirimlerine göre sıklığı olarak tanımlanmıştır. 303 yükseköğretim öğrencisiyle nicel, kesitsel bir anket çalışması yapılmıştır. Veriler, ölçüm modelinin güvenilirliği ve geçerliliği doğrulandıktan sonra Smart-PLS'de Yapısal Eşitlik Modellemesi (YEM) kullanılarak analiz edilmiştir. Algılanan kullanım kolaylığının hem algılanan yararı hem de gerçek kullanımı önemli ölçüde etkilediği gösterilmiştir. Algılanan yarar ayrıca kullanım sıklığını da olumlu yönde etkilemektedir. Güven, öğrencilerin kullanım kolaylığı ve yarar algılarını şekillendirmekte ancak kullanımı doğrudan etkilememektedir. Üstelik kullanımın bireysel sonuçlar üzerinde güçlü bir olumlu etkisi vardır ve sık kullanımla ilişkili akademik ve kişisel yararı ortaya koymaktadır. Kullanım kolaylığı ve algılanan yarar, öğrencilerin üretken yapay zekâyı kullanmalarının temel belirleyicileridir. Güven, bu algıları şekillendirerek dolaylı olarak benimsemeyi etkilemektedir. Bu araçların sürekli kullanımı akademik ve kişisel sonuçları iyileştirmekte ve genişletilmiş TKM, yükseköğretim bağlamlarında üretken yapay zekânın benimsenmesini açıklamak için uygun bir çerçeve olduğunu kanıtlamaktadır.

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Introduction

Generative Artificial Intelligence (hereafter Gen-AI) is rapidly transforming the landscape of higher education, offering novel opportunities for personalized learning and innovative assessment methods. Among the diverse Gen-AI applications, AI-driven conversational agents—commonly referred to as chatbots (hereafter chatbots)—play a particularly prominent role in supporting student learning by generating personalized content, adaptive exercises, and interactive simulations. These tools are increasingly transforming traditional teaching methods and enriching the learning experience (Kumar et al., 2025).

The integration of chatbots into higher education has significantly transformed conventional pedagogical approaches, altering how students learn, interact, and construct knowledge. Chatbots such as ChatGPT, Copilot, and Gemini are increasingly employed to facilitate personalized learning, provide adaptive feedback, and offer cognitive scaffolding (Al-Kadi & Ali, 2024). As these technologies become more deeply embedded within academic ecosystems, understanding the determinants that influence students' usage of such tools is essential to ensure their sustainable and effective adoption in educational settings (Holzmann, 2025).

Although the Technology Acceptance Model (hereafter TAM) (Davis, 1987; Davis, 1989) and its extended versions have been widely employed to explain users' acceptance of new technologies in various contexts (Gelibolu, 2024; Sharma et al., 2024), their adaptation to chatbot-based educational tools remains limited. Prior research has predominantly focused on general artificial intelligence applications or conventional Learning Management Systems (Castillo-Martínez et al., 2024), often overlooking the distinctive features of chatbots, such as their conversational intelligence, adaptive learning potential, and ability to simulate higher-order cognitive processes (Xue et al., 2025; Heilala et al., 2025). This gap highlights the importance of extending the TAM to more accurately explain students' behavioral intentions and their sustained engagement with these emerging chatbot tools.

To fill this research gap, the current study proposes and empirically tests an extended TAM framework that incorporates trust as a key external construct and individual impact as an outcome variable. Trust is crucial in the adoption of chatbots, as students must rely on AI-generated outputs that may differ in accuracy, ethical considerations, or academic integrity. By integrating trust into the TAM framework, the study aims to examine an extended Technology Acceptance Model in which trust is modelled as an antecedent to perceived ease of use and perceived usefulness, as well as a direct predictor of self-reported usage (hereafter Usage). Furthermore, the study incorporates individual impact as a post-adoption outcome, thereby bridging the adoption-focused TAM literature with outcomes-based perspectives by examining how Usage translates into perceived academic and personal benefits.

This study contributes to the literature on educational technology adoption in multiple ways. Theoretically, it extends the traditional TAM by incorporating trust and individual impact, providing a more comprehensive understanding of students' sustained engagement with chatbot tools in higher education. Unlike many prior studies that focus primarily on a single tool such as ChatGPT, this research considers a broader range of chatbots, including emerging platforms like Gemini, reflecting their increasing accessibility and relevance for students. By integrating trust as a key external construct, the study underscores the importance of students' confidence in AI-generated outputs in shaping perceptions of ease of use and perceived usefulness. The inclusion of individual impact addresses a notable gap in the literature by capturing the individual benefits and learning outcomes students derive from engaging with chatbots, including cognitive, academic, and personal gains. Practically, the findings can guide educators, instructional designers, and policymakers in fostering trustworthy, ethical, and pedagogically effective chatbot integration strategies that enhance learners' academic experience and personal outcomes.

This study aims to examine the role of trust and individual impact in shaping students' perceptions of ease of use and perceived usefulness, and how these perceptions influence their usage (usage frequency) with chatbot-based educational tools in the context of the extended TAM framework. The research was conducted using a quantitative design with a convenience sampling method, and data were collected from 303 higher education students. The collected data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM), and the study's hypotheses were subsequently tested using SmartPLS 4.

Based on the findings, the study provides theoretical and practical implications, offering recommendations to researchers and practitioners for the effective, trustworthy, and pedagogically beneficial integration of chatbots in higher education contexts.

Literature Review and Hypotheses Development

In recent years, Turkish higher education institutions have increasingly integrated digital technologies into teaching and learning environments. Following the COVID-19 pandemic, the rapid digital transformation of universities accelerated students' exposure to online learning tools (Gökçearslan et al., 2023). The emergence of generative AI tools such as ChatGPT has further reshaped students' learning practices. This transformation is primarily driven by the transition from passive information consumption to active, personalized interaction with AI agents. In higher education, Gen-AI impacts learning practices by serving as an on-demand tutor that facilitates "scaffolded learning." For instance, research indicates that students utilize these tools for brainstorming, complex concept simplification, and coding assistance, which optimizes their cognitive load (Mollick & Mollick, 2023). Moreover, generative AI influences learning experiences by providing immediate, formative feedback, allowing students to iterate on their assignments in real-time a process previously constrained by limited faculty availability (Su & Yang, 2023).

However, the influence on student experience is dual-faceted. While it enhances self-regulated learning and digital literacy, it also introduces challenges related to "algorithmic dependence" and shifts the focus from rote memorization to critical prompt engineering. Studies have shown that when students use Gen-AI as a collaborative partner rather than a mere answer generator, their perceived individual impact and academic productivity increase significantly (Yan et al., 2024). Consequently, the integration of these tools does not merely supplement existing practices but fundamentally redefines the student's role from a recipient of knowledge to a co-creator of academic content. However, empirical research examining the determinants and outcomes of Gen-AI adoption within the Turkish higher education context remains limited (Karahan Adalı & Bilgili, 2025). This study addresses this gap by focusing on university students in Türkiye.

Generative AI in Higher Education

In the educational context, chatbots are of particular importance due to their potential to transform and enrich learning processes (Kumar et al., 2025). Generative AI (Gen-AI) chatbots are advanced conversational agents powered by Large Language Models (LLMs) that utilize deep learning to generate human-like text, code, and multimedia content based on user prompts (Dwivedi et al., 2023). Within higher education, these tools are generally categorized into general-purpose platforms (e.g., ChatGPT, Google Gemini) and specialized academic assistants designed for literature synthesis and research (e.g., Perplexity AI). Their integration offers significant advantages, such as 24/7 accessibility to personalized learning support, the democratization of quality feedback, and the reduction of cognitive and administrative burdens for students (Baidoo-Anu & Owusu Ansah, 2023).

Particularly in higher education, chatbots hold transformative potential for learning, teaching, and assessment (Yan et al., 2024; Kasneci et al., 2023). Recent studies highlight its diverse capabilities, such as delivering comprehensive feedback, outperforming average students in reflective writing, supporting multimedia learning, and enabling adaptive educational content (Dai et al., 2023; Vartiainen & Tedre, 2023, Wang et al., 2024). Chatbots that engage users through natural language interaction have become valuable tools in higher education (Stöhr et al, 2024). Given their advantages, researching chatbot integration into education provides a broad framework for understanding their impact across diverse contexts. Studies in this area have examined individuals' acceptance of chatbots as novel technologies, employing various theoretical models and frameworks to explain their adoption and use. Recent research highlights how these interactive AI-driven tools support personalized learning, real-time feedback, and academic assistance, enhancing student engagement and learning outcomes (Shahzad et al, 2025; Mustofa et al., 2025; Mirriahi et al., 2025; Kong et al., 2024).

Despite the growing body of research highlighting the pedagogical potential of generative AI tools, less attention has been devoted to understanding the psychological and perceptual mechanisms that drive students' usage behavior. Previous studies (Pitts & Motamedi, 2025; Sio et al., 2025; Tian et al., 2024) primarily highlight performance improvement and engagement outcomes; however, fewer investigations

systematically explore the cognitive and trust-related factors that affect students' acceptance and ongoing interaction with AI-based chatbots. This gap calls for the application and extension of established technology acceptance frameworks in the context of generative AI in higher education.

Technology Acceptance Model

TAM (Davis, 1989) is one of the most widely used frameworks for predicting individuals' intentions to adopt and use technology. TAM focuses on understanding how users accept technology and what factors influence their willingness to use a particular technological system. Grounded in the Theory of Reasoned Action, TAM posits that "perceived usefulness" and "perceived ease of use" shape users' attitudes toward a system, which in turn affect their behavioral intention to use it (Venkatesh & Davis, 2000:187). With the continuous advancement of technology and the emergence of artificial intelligence, the TAM has been increasingly extended to establish a more integrated framework that captures various technological systems (Venkatesh, 2022). Recognizing that technology use is also shaped by social dynamics, recent extensions of TAM have incorporated constructs such as social influence, facilitating conditions, and trust to account for the broader technological context (Venkatesh et al., 2012; Gaber et al., 2023). Early investigations predominantly conducted in the context of computer science, social sciences, business, management, and accounting examined TAM constructs such as system usability, perceived trust, ease of use, e-learning, adoption behavior, e-commerce, and social media engagement (Gupta et al., 2025).In recent years, TAM has become a frequently used theoretical foundation in higher education research, particularly for examining how students and educators accept and adopt AI-powered chatbots (Almogren et al., 2024; Mustofa et al., 2025).

Hypothesis Development

Perceived Ease of Use and Perceived Usefulness

According to the Technology Acceptance Model (TAM), perceived ease of use (PEU) refers to the extent to which an individual believes that using a system requires minimal effort (Davis, 1989, p. 320). In educational settings, PEU reflects whether students perceive a platform as intuitive, easy to navigate, and requiring little technical expertise (Ibrahim & Shiring, 2022). Perceived usefulness (PU), on the other hand, refers to the extent to which an individual believes that using a system enhances their performance (Davis, 1989, p.320). In the context of education, this concept captures students' perceptions that technology supports learning processes, improves efficiency, and facilitates academic tasks (Chen et al., 2025, p. 3).

Empirical research conducted in AI-based educational contexts indicates that both PEU and PU are significant determinants of students' adoption and self-reported usage of generative AI tools (Almogren et al., 2024; Iranmanesh et al., 2022; Yu et al., 2024). In the present study, "usage" is conceptualized as students' self-reported frequency of using Gen-AI chatbots (e.g., daily or frequent use). Unlike post-adoption or expectation-confirmation frameworks that focus on continuance intention, this study follows the traditional TAM perspective by examining realized usage behavior as a behavioral outcome of perceived usefulness and perceived ease of use. Specifically, PEU is expected to enhance PU by reducing the cognitive effort required to use the system, whereas PU drives self-reported usage by highlighting the value of technology in improving learning outcomes (Malik et al., 2021; Choudhury & Shamszare, 2023; Chen et al., 2025).

The adoption of generative AI tools has also gained significant traction in the Turkish higher education context. Recent empirical studies support the theoretical relationships proposed by TAM across different academic disciplines. For example, Büyükeke (2025) examined student acceptance of generative AI tools in programming courses and found that perceived usefulness and perceived ease of use are critical determinants of adoption among students in technical fields. This finding is reinforced by the systematic review conducted by Özgül (2026), which highlights that Gen-AI tools in programming education enhance student engagement and learning performance through their intuitive interfaces and practical benefits. Similarly, Göküş and Yılmaz (2025) investigated theology undergraduate students' behavioral intentions regarding chatbot use and demonstrated that even in non-technical disciplines, students' intentions are strongly influenced by the perceived accessibility and usefulness of AI-based systems. Taken together, these studies highlight the cross-disciplinary relevance of TAM variables in the Turkish context and suggest that Turkish students' perceptions align closely with broader global technological trends.

Based on these theoretical and empirical insights, the following hypotheses are proposed:

H1. PEU positively influences PU.

H2. PEU positively influences students' usage of chatbots.

H3. PU positively influences students' usage of chatbots.

Trust

Trust is a fundamental construct in technology acceptance research, referring to users' belief that a technology can be relied upon to provide accurate, reliable, and impartial information (Wu et al., 2011; Senali et al., 2024). Within the Technology Acceptance Model (TAM), trust has been positioned as an antecedent to perceived ease of use (PEU) and perceived usefulness (PU), shaping users' attitudes and behavioral intentions toward adoption (Gefen et al., 2003; Shin, 2021; Gelibolu & Mouloudj, 2025). By reducing uncertainty and perceived risk, trust enhances users' confidence in interacting with digital systems and strengthens their cognitive evaluations of technological benefits.

In various contexts, empirical research has confirmed the crucial role of trust in new technology acceptance. Trust has been shown to positively influence usage of recommendation systems (Shin, 2020), adoption of online shopping platforms (Gefen et al., 2003), online banking services (Suh & Han, 2002), social networking sites (Sledgianowski & Kulviwat, 2009), and health applications (Beldad & Hegner, 2018). These findings indicate that trust consistently strengthens users' perceptions of usefulness and ease of use, thereby fostering favorable attitudes and realized usage behaviors.

In the context of artificial intelligence systems, trust assumes heightened importance due to the opaque and autonomous nature of algorithmic decision-making. Unlike traditional information systems, generative AI tools operate through complex machine learning architectures that are often non-transparent to users. Research on trust in automation suggests that when systems generate probabilistic or uncertain outputs, users rely heavily on perceived reliability and credibility to reduce cognitive risk (Lee & See, 2004; Glikson & Woolley, 2020). In educational environments—where the accuracy and credibility of information directly affect academic performance—trust becomes a critical mechanism for mitigating epistemic uncertainty and facilitating acceptance of AI-supported learning tools (Kasneci et al., 2023; Ofosu-Ampong et al., 2023).

Although trust has only recently begun to be systematically examined in educational AI contexts, emerging studies suggest that it functions as a precursor to perceived ease of use, perceived usefulness, and adoption of intelligent learning systems (Parsonage et al., 2023; Zhang et al., 2021). In the case of ChatGPT, trust refers to the extent to which students perceive the system as reliable, transparent, and accurate in delivering academic information (Dahri et al., 2025). Factors such as system transparency, reliability, and data security are central to building students' trust in AI-powered educational systems (Ofosu-Ampong et al., 2023). Consequently, students who perceive ChatGPT as trustworthy are more likely to evaluate it as easy to use, useful, and worthy of engagement.

Within extended TAM frameworks, trust is frequently conceptualized not only as an antecedent to PEU and PU but also as a potential direct predictor of usage behavior, particularly in high-uncertainty digital environments (Gefen et al., 2003; Shin, 2021). In generative AI contexts, students may rely directly on their trust judgments when deciding whether to use the system, beyond purely cognitive evaluations of ease and usefulness. Examining both indirect and direct effects of trust therefore provides a more comprehensive understanding of AI adoption in higher education.

Based on these theoretical considerations, the following hypotheses are proposed:

H4: Trust (TR) positively influences PEU.

H5: Trust (TR) positively influences PU.

H6: Trust (TR) positively influences usage.

Individual Impact

The use of information systems often leads to positive outcomes for individuals, such as improved performance, productivity, and learning, conceptualized as *individual impact* in the Information Systems Success Model (DeLone & McLean, 2003). While the Technology Acceptance Model (TAM) primarily explains determinants of technology adoption, the IS Success Model extends this perspective by linking system use to performance-related outcomes. Integrating these perspectives allows the present study to bridge the adoption and outcome literature.

In educational settings, the integration of digital technologies has been shown to enhance learners' productivity, task performance, and perceived learning effectiveness (Cidral et al., 2018). In the context of generative AI, individual impact refers to the academic and cognitive benefits students perceive as a result of using ChatGPT for learning purposes (Boubker, 2024). Frequent engagement with AI-based tools may facilitate deeper understanding, independent learning, and more efficient task completion.

Empirical findings provide mixed but insightful evidence. Ashraf et al. (2025) report that regular ChatGPT users demonstrate improved academic performance and study efficiency. Similarly, Wang and Fan (2025) find that sustained usage is associated with greater academic preparedness and stronger self-regulated learning behaviors. However, Boubker (2024) observes no significant direct effect of ChatGPT usage on individual outcomes, suggesting that mediating mechanisms such as satisfaction or perceived usefulness may influence this relationship.

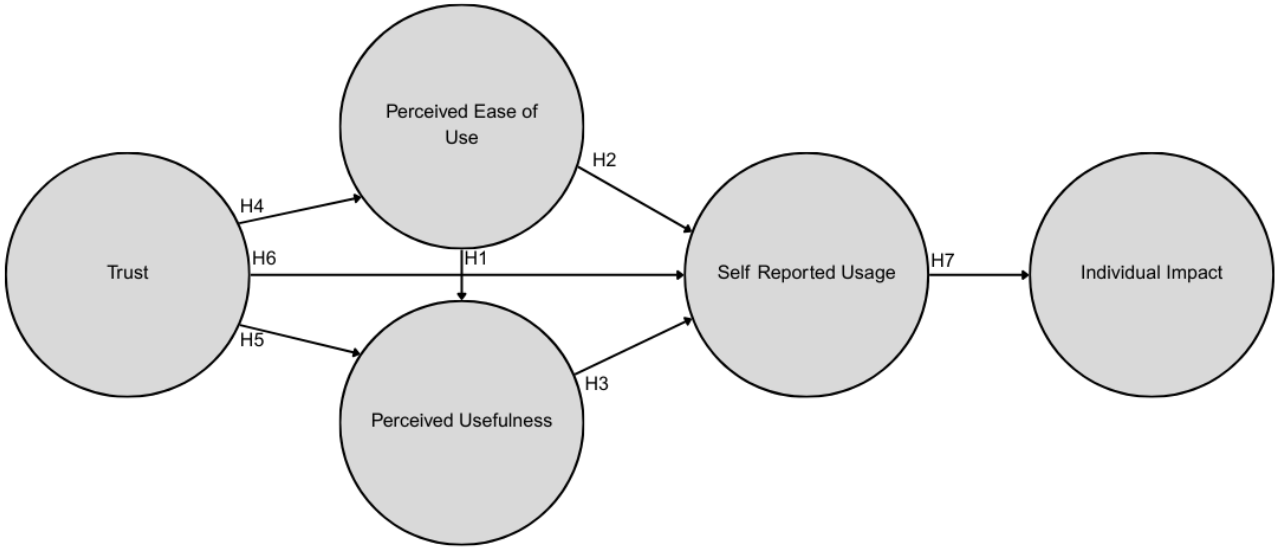
Given this theoretical grounding and empirical evidence, the present study posits that higher levels of usage are positively associated with Individual Impact.

H7: Usage (USE) positively influences Individual impact (IMP).

The research model, grounded in TAM, was derived from the existing literature, as presented in Figure 1

Figure 1

Research Model



Method

Sampling

The sample of this study consisted of 303 higher education students enrolled at Gazi University, a public university in Türkiye. Participants were recruited from five different faculties and two graduate institutes, ensuring representation from diverse academic disciplines within the institution. Sample size adequacy was assessed using a priori power analysis conducted with G*Power (Faul et al., 2009). Using the

F-test family for linear multiple regression (fixed model, R^2 deviation from zero), assuming a medium effect size ($f^2 = 0.15$), a significance level of 0.05, statistical power of 0.95, and three predictors (the maximum number of structural paths directed at an endogenous construct), the required minimum sample size was substantially lower than the actual sample size (N = 303). Therefore, the sample size is considered statistically adequate. A convenience sampling approach was adopted owing to its practicality and accessibility (Lefever et al., 2007). The survey link was disseminated through academic networks, student communication groups, and voluntary sharing channels within the university. No personal contact information was obtained from institutional records or official databases, and participation was entirely voluntary. Data were collected through an online survey designed via Google Forms and distributed through digital communication channels, including WhatsApp and email. This study was approved by the Ethical Commission of Gazi University in accordance with the relevant institutional ethical guidelines (Approval No. E-77082166-604.01-1189515). The data collection process was carried out over a one-month period, beginning on April 15, 2025. Prior to participation, respondents were provided with a detailed explanation of the study's objectives and informed that participation was voluntary, that they could withdraw at any time without penalty, and that their responses would remain anonymous and confidential. A total of 342 responses were initially obtained. After excluding 39 surveys due to missing or inconsistent data, the final dataset consisted of 303 valid responses, which were subsequently used for analysis.

Measures

The questionnaire employed in this research was composed of two main parts, preceded by an introductory section explaining the aim and scope of the study. The first section of the instrument gathered demographic information to contextualize the findings. Specifically, data were collected regarding participants' gender, academic level (undergraduate or graduate), and primary purposes for using Gen-AI chatbots (e.g., research, education, entertainment, or casual conversation). These variables were selected to determine whether the sample represented a diverse range of academic backgrounds and usage habits in higher education. In addition to demographic variables, participants were asked about their general use of generative AI chatbots. In the sample, all participants reported having prior experience using generative AI chatbots, and the usage variable captured the frequency with which students reported interacting with such tools. The second part incorporated measurement instruments assessing individual impact, trust in chatbots, perceived usefulness, perceived ease of use, and actual chatbot usage. All constructs were operationalized using established and validated scales reported in previous studies (Gelibolu, 2024). Individual impact was evaluated through three items adapted from Boubker (2024), while self-reported usage behavior was assessed with three items based on the framework of DeLone and McLean (2003). Perceived usefulness and perceived ease of use were measured using four and three items, respectively, developed by Davis (1989). Trust toward chatbots was assessed using three items adapted from Choung et al. (2023). Participants evaluated the items using a five-point Likert scale, where 1 indicated 'strongly disagree' and 5 indicated 'strongly agree.' To ensure both linguistic and conceptual accuracy, the scales were carefully reviewed. Furthermore, formal permission for the use and adaptation of all measurement scales was obtained from the respective authors or copyright owners to comply with academic ethical standards. "To ensure the linguistic and conceptual accuracy of the scales, a rigorous translation process was followed. Initially, the items were translated into Turkish and then back translated into English by two scholars. The preliminary Turkish translations were reviewed by scholars from Technology Education Department at Hatay Mustafa Kemal University. Afterward, an academician from the Center for Foreign Languages conducted the back-translation. The comparison between the original and the back-translated versions demonstrated a high level of semantic consistency. For further refinement of language quality, the Turkish version of the scale was jointly examined by academicians in the Turkish Education Department, who suggested revisions to enhance clarity and grammatical correctness. Subsequently, the revised instrument was evaluated by experts experienced in psychometric scale development. Prior to the main data collection, a pilot test was administered to a group of 30 participants to identify potential ambiguities or misunderstandings. Based on the feedback received, minor adjustments were applied to improve item comprehensibility. Thus, the finalized survey was administered to the participants. In total, 303 valid responses were obtained and analyzed.

Analysis and Results

Initially, the characteristics of the participant group were summarized through descriptive analyses. Following this step, the validity of the measurement constructs was examined with PLS-SEM. The hypothesis of the research was tested with Smart PLS 4 which is considered appropriate for studies involving small sized samples (Henseler et al., 2015).

Descriptive statistics

As presented in Table 1, the demographic composition of the participants shows a higher representation of female students (68.65%) compared to male students (31.35%). In terms of academic standing, approximately three quarters of the sample consists of undergraduate students (74.92%). The analysis of usage purposes provides critical insights into how students integrate generative AI into their lives. The results indicate that the primary drivers for chatbot engagement are academic and professional; nearly 80% of students utilize these tools for information retrieval/research (79.87%) and education/skill development (79.21%). While a significant portion (42.57%) also engages with chatbots for entertainment, the high frequency of academic-related usage suggests that the participants predominantly view generative AI as a functional educational resource rather than a purely recreational tool. This multi-purpose engagement highlights the versatility of Gen-AI tools in the higher education ecosystem.

Table 1

Descriptive Statistics of Sample

Variable	Category	n	%
Gender	Female	208	68.65
	Male	95	31.35
Academic Level	Undergraduate	227	74.92
	Graduate	76	25.08
Usage Purpose	Information Retrieval / Research	242	79.87
	Education / Skill Development	240	79.21

Additionally, these findings indicate a high level of digital engagement among students, suggesting that they are not only familiar with emerging technologies but also actively integrating them into their learning processes, which may have important implications for educational practices and technology adoption in higher education.

Measurement model assessment

The measurement model was assessed using Partial Least Squares Structural Equation Modeling (PLS-SEM), following established guidelines for variance-based SEM (Hair et al., 2021). Internal consistency reliability, convergent validity, and discriminant validity were systematically evaluated. Indicator reliability was examined through outer loadings. All retained items exceeded the acceptable threshold of 0.50, and the majority surpassed the preferred level of 0.70 (Hair et al., 2021). One item under the Individual Impact construct (IMP3) was removed due to its low factor loading, which fell below the recommended threshold. The removal of this item improved the Average Variance Extracted (AVE) and Composite Reliability (CR) values while preserving the conceptual integrity of the construct. Although the factor loadings of PU1 (0.646) and PU2 (0.660) were slightly below the preferred 0.70 level, they exceeded the acceptable minimum of 0.60 for exploratory and applied research contexts (Hair et al., 2021). The Perceived Usefulness construct demonstrated satisfactory internal consistency (Cronbach's alpha = 0.819; CR = 0.820) and adequate convergent validity (AVE = 0.535 > 0.50). Therefore, these items were retained to preserve content validity, as their removal would not substantially improve model quality.

Convergent validity was confirmed, as all AVE values exceeded the recommended threshold of 0.50 (Bagozzi & Yi, 1988). Internal consistency reliability was supported by Cronbach's alpha values ranging from

0.792 to 0.929 and Composite Reliability values above 0.70 (Fornell & Larcker, 1981; Hair et al., 2021). The results of the measurement model are presented in Table 2.

Table 2

Measurement Model Results

Constructs/Items	FL	CA	CR	AVE
Trust towards Chatbot Use		0.867	0.867	0.685
TR1. I believe that the information provided by Chatbot is trustworthy	0.800			
TR2. The information provided by chatbot is reliable	0.838			
TR3. The information provided by chatbot has integrity	0.843			
Perceived Ease of Use		0.806	0.808	0.584
PEU1. I find chatbots easy to use.	0.794			
PEU2. My interaction with chatbots is clear and easy to understand.	0.781			
PEU3. I find it easy to get chatbots to do what I want it to do	0.716			
Perceived Usefulness		0.819	0.820	0.535
PU1. Using chatbots will improve my learning.	0.646			
PU2. Using chatbots will enhance my effectiveness.	0.660			
PU3. I find chatbots useful tools in my learning.	0.845			
PU4. Using chatbots will save my time.	0.757			
Chatbot Usage		0.929	0.932	0.820
USE1. I use chatbots on daily basis.	0.818			
USE2. I use chatbots frequently.	0.925			
USE3. I visit chatbots often.	0.967			
Individual Impact		0.792	0.800	0.669
IMP1. Chatbots improve my grade for the subject.	0.895			
IMP2.Chatbot use has improved my overall learning performance.	0.733			

Notes: Factor Loading (FL), Cronbach's Alpha (CA), Composite Reliability (CR), Average Variance Extracted (AVE)

Discriminant validity was further assessed using the HTMT criterion. All HTMT values were below the conservative threshold of 0.85(Henseler et al., 2015). Additionally, bootstrapping with 5,000 subsamples (N = 303) was conducted to obtain 95% bias-corrected confidence intervals. None of the upper bounds of the confidence intervals included the value 1.00, confirming that discriminant validity was established (see Table 3).

Table 3

HTMT Ratios with 95% Confidence Intervals

Variables	1	2	3	4	5
1. Perceived Ease of Use					
2. Individual impact	0.546 [0.412–0.668]	—			
3. Perceived Usefulness	0.682 [0.554–0.787]	0.716 [0.615–0.804]	—		
4.Trust	0.493 [0.348–0.614]	0.547 [0.411–0.669]	0.541 [0.415–0.647]	—	
5. Chatbot Usage	0.532 [0.428–0.625]	0.643 [0.527–0.751]	0.541 [0.435–0.638]	0.315 [0.185–0.430]	

Table 3 presents the Heterotrait–Monotrait (HTMT) ratios along with their 95% confidence intervals to assess discriminant validity among the constructs. All HTMT values are below the commonly recommended threshold of 0.85, indicating satisfactory discriminant validity. Furthermore, none of the confidence intervals include the value of 1, which provides additional evidence that the constructs are empirically distinct from each other. These results suggest that each construct captures a unique aspect of the model, supporting the adequacy of the measurement model in terms of discriminant validity.

Model Fit Assessment

The structural model showed acceptable fit (SRMR < 0.10; NFI ≥ 0.80) (Hooper et al., 2008) (see Table 4). In line with current PLS-SEM guidelines (Hair et al., 2021), model fit was further evaluated using SRMR, NFI, and discrepancy measures (d_ULS and d_G). The saturated model demonstrated excellent fit (SRMR = 0.046), while the estimated model yielded SRMR = 0.093, remaining below the recommended 0.10 threshold for variance-based SEM. The NFI value (0.897) approaches the 0.90 benchmark and exceeds the commonly accepted 0.80 adequacy criterion. Additionally, bootstrapping results indicated that the original d_ULS and d_G values were below their respective 95% HI values, suggesting no significant discrepancy between the model-implied and empirical correlation matrices.

Table 4

Structural Model Fit

Fit Indices	Saturated model	Estimated model
SRMR	0.046	0.093
d_ULS	0.252	1.027
d_G	0.138	0.187
Chi-square	218.767	289.692
NFI	0.922	0.897

Common method variance (CMV) was examined using Harman's single-factor test (Podsakoff et al., 2003) and the full collinearity approach (Kock, 2015). With only 42% variance explained by the first factor, CMV does not appear to be an issue. Consistently, the full collinearity test produced VIF values below 3.3 for all constructs, further supporting the absence of common method bias (Kock, 2015). To evaluate the structural model, VIF (multicollinearity), R^2 (explained variance), f^2 (effect size), and Q^2 (predictive relevance) indicators were analyzed (see Table 5). All inner VIF values were under the recommended limit of 5 (Hair et al., 2018), confirming that multicollinearity was not an issue within the model. The R^2 values for the endogenous constructs were 0.240 for perceived ease of use, 0.526 for perceived usefulness, 0.342 for Use, and 0.408 for individual impact. These results indicate that the model explains 24% of the variance in perceived ease of use, 53% of perceived usefulness, 34% of Use, and 41% of Individual Impact.

To assess the explanatory power of the structural model, the effect sizes (f^2) of each significant path were examined. According to Cohen's (1988) guidelines—where f^2 values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively—the effect of usage on Individual Impact is very large (f^2 = 0.688), indicating that self-reported system use is a strong determinant of the individual outcomes derived from it. The effect of perceived ease of use on perceived usefulness is large (f^2 = 0.506), suggesting that ease of use plays a substantial role in shaping users' perceptions of usefulness.

The effect of trust on perceived ease of use is medium-to-large (f^2 = 0.316), highlighting that trust contributes notably to how users perceive the simplicity of the system. In contrast, the effect of trust on perceived usefulness is small (f^2 = 0.108), while the effect of perceived ease of use on usage is small (f^2 = 0.072), and the effect of perceived Usefulness on usage is also small (f^2 = 0.083), indicating that although these factors influence system use, their impact remains moderate compared to other pathways in the model. Finally, the effect of trust on actual system use is negligible (f^2 = 0.000), implying that trust does not directly influence actual system use when mediated by other constructs.

The predictive relevance of the model was assessed using the Stone–Geisser Q^2 values obtained via the blindfolding procedure. A Q^2 value greater than zero indicates predictive relevance for a given endogenous construct (Hair et al., 2018). In this study, all endogenous variables showed positive Q^2 values—0.161 for perceived ease of use, 0.198 for perceived usefulness, 0.161 for usage, and 0.116 for Individual Impact—confirming the model's satisfactory predictive performance.

Table 5

Assessment of Structural Model Quality

Constructs	VIF	f2	R2	Q2
Trust -> Perceived Ease of Use	1.000	0.316	0.240	0.161
Usage -> Individual Impact	1.000	0.688	0.408	0.116
Perceived Ease of Use -> Perceived Usefulness	1.316	0.506	0.526	0.198
Trust -> Perceived Usefulness	1.316	0.108		
Perceived Ease of Use -> Usage	1.982	0.072	0.342	0.161
Perceived Usefulness -> Usage	2.109	0.083		
Trust -> Usage	1.457	0.000		

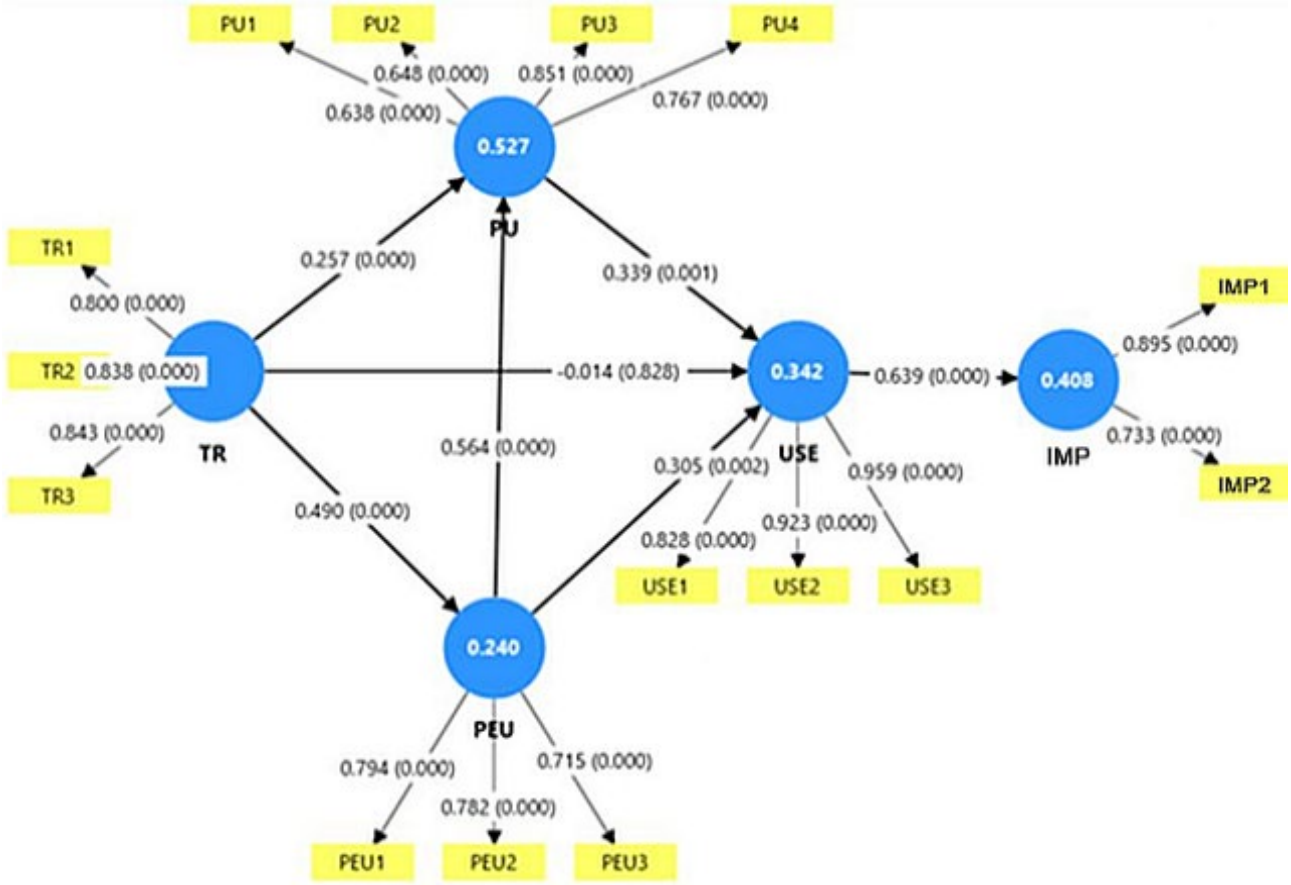
Overall, these findings indicate that explanatory power of research model is strong and predictive accuracy is acceptable. The large and medium effect sizes observed in the key relationships reinforce the robustness of the theoretical framework, suggesting that trust, perceived ease of use, and actual system use are critical determinants of perceived usefulness and individual impact. As demonstrated in Table 5, Q^2 scores which are above zero further confirm that the endogenous constructs in the model possess predictive capability.

Findings

The structural model was assessed through analyses conducted in Smart PLS version 4. To assess the significance of path coefficients and indicator loadings, a bootstrapping procedure with 10,000 resamples was employed. The results of the structural model analysis are demonstrated in Figure 2 and Table 6. The results showed that perceived ease of use (PEU) significantly affected perceived usefulness (PU) ($\beta = 0.564$, $t = 8.109$, $p < 0.001$), supporting H1. In addition, PEU had a direct effect on self-reported usage (USE) ($\beta = 0.305$, $t = 3.093$, $p = 0.002$), thus H2 was supported. The analysis further indicated that perceived usefulness (PU) significantly affected usage ($\beta = 0.339$, $t = 3.424$, $p = 0.001$), supporting H3. Moreover, trust (TR) significantly affected PEU ($\beta = 0.490$, $t = 7.115$, $p < 0.001$) and significantly affected PU ($\beta = 0.257$, $t = 4.083$, $p < 0.001$); therefore, both H4 and H5 were supported. However, the direct effect of TR on USE was not significant ($\beta = -0.014$, $t = 0.217$, $p = 0.828$), meaning H6 was not supported. Finally, the results demonstrated that self-reported usage (USE) had a strong positive effect on Individual impact (IMP) ($\beta = 0.639$, $t = 11.232$, $p < 0.001$), which supports H7. To further explore the non-significant direct effect of trust on self-reported usage (H6), specific indirect effects were examined via bootstrapping to test for mediation. The results revealed that trust exerts a significant indirect influence on self-reported usage through three distinct paths: via PEU ($\beta = 0.150$, $p = 0.006$), via PU ($\beta = 0.087$, $p = 0.015$), and through a serial mediation involving both PEU and PU ($\beta = 0.094$, $p = 0.006$). The combination of significant indirect effects and a non-significant direct path provide empirical evidence for a full mediation mechanism. This suggests that trust acts as a foundational "perceptual scaffolding" that enhances usage not by triggering it directly, but by fostering the necessary cognitive environment where students can appreciate the system's ease and utility.

Figure 2

Structural Model Analyses Results



Following the validation of the measurement model, structural model analysis was conducted to test the proposed theoretical framework and the hypothesized relationships between the constructs. This analysis provides path coefficients and statistical significance levels to determine the direct effects on technology acceptance and usage behavior. The results of the structural model, including the hypothesis testing outcomes, path coefficients, and significance levels, are presented in detail in Table 6.

Table 6

Results of Structural Model

Hypothesis	Path	β	t-value	p-value	Supported
H1	PEU → PU	0.564	8.109	0.000	Yes
H2	PEU → USE	0.305	3.093	0.002	Yes
H3	PU → USE	0.339	3.424	0.001	Yes
H4	TR → PEU	0.490	7.115	0.000	Yes
H5	TR → PU	0.257	4.083	0.000	Yes
H6	TR → USE	-0.014	0.217	0.828	No
H7	USE → IMP	0.639	11.232	0.000	Yes

The structural model results presented in Table 6 provide empirical support for the hypothesized relationships within the proposed framework. The path analysis reveals that Perceived Usefulness (PU) and Perceived Ease of Use (PEU) are significant predictors of students' self reported usage behavior (USE) on generative AI tools. Specifically, the strong positive path coefficient from PEU to PU suggests that when students find these AI platforms intuitive and user-friendly, their perception of the tool's academic utility significantly increases.

Furthermore, the results indicate that Trust plays a critical role in the acceptance process, acting as a foundational element that enhances the individual impact of technology. The significant relationship

between behavioral Intention and self-reported usage behavior confirms that students' positive predispositions toward Gen-AI are effectively translating into regular academic practice. Finally, the positive and significant path toward Individual Impact demonstrates that the integration of these tools contributes tangibly to students' perceived academic performance and productivity. Overall, the model accounts for a substantial proportion of the variance in Gen-AI adoption, validating the relevance of the extended TAM framework in the Turkish higher education context.

Discussion

The results showed that perceived ease of use had a significant positive impact on both perceived usefulness (H1 supported) and self-reported usage (H2 supported), while perceived usefulness also strongly influenced self-reported usage (H3 supported). This relationship can be specifically attributed to the unique conversational affordances of chatbots. Unlike traditional static tools, the natural language processing capabilities of Gen-AI allow for a seamless, dialogue-based interaction that mirrors human communication, thereby significantly reducing the cognitive effort required to operate the system (PEU). Furthermore, the adaptivity of these tools their ability to provide context-aware, personalized responses—directly enhances their utility in an educational setting (PU). As students engage in iterative prompting, the chatbot adapts to their specific learning needs, making the technology feel less like a rigid software and more like a responsive learning partner. This alignment between the system's adaptive features and the users' goal-oriented tasks underscores why PU emerged as the strongest predictor of continued engagement, reinforcing the core tenets of TAM (Davis, 1987) within the specific context of conversational AI. Among these relationships, perceived usefulness emerged as the key driver of self-reported usage (self-reported usage frequency), underscoring its central role within the Technology Acceptance Model (Davis, 1987). These findings are consistent with TAM's foundational assumptions, suggesting that users' perceptions of a system's ease of use indirectly foster usage through enhanced perceptions of usefulness. This outcome also aligns with prior research emphasizing that continued technology usage is primarily driven by the perceived utility of the system in achieving users' goals (Iancu & Iancu, 2023; Agyare et al., 2025).

The results indicated that trust had a significant positive effect on perceived ease of use (H4 supported) and perceived usefulness (H5 supported), but its direct impact on self-reported usage was not significant (H6 not supported). These findings suggest that when students trust AI-based chatbots, they are more likely to find them easy to use and perceive them as useful learning aids, consistent with the assumptions of the Technology Acceptance Model (Davis, 1987). Trust appears to facilitate users' confidence in interacting with the system, thereby reducing uncertainty and enhancing perceptions of ease and usefulness. These findings align with Wu et al. (2011).

Furthermore, the non-significant direct effect of trust on usage (β=-0.014, p=0.828), coupled with its strong influence on PEU (β=0.490, p=0.000) and PU (β=0.257, p=0.000), points to a full mediation mechanism. In this context, trust functions as 'perceptual scaffolding'—a foundational psychological layer that does not directly trigger behavior but creates the necessary cognitive environment for students to appreciate the system's ease and utility. Quantitatively, the influence of trust on engagement is channeled entirely through these TAM constructs, suggesting that without trust as a stabilizing factor, the perceived utility of the AI might not be fully realized by the user.

Beyond its indirect role, trust in generative AI environments may be more appropriately conceptualized as a background condition or enabling antecedent rather than as a direct behavioral driver. In rapidly normalizing AI contexts, students may perceive chatbot usage as instrumental and task-oriented, reducing the salience of trust as a conscious decision factor. In several cases, trust may function as a threshold variable once a minimum level of trust is established, behavioral engagement becomes primarily guided by perceived usefulness and efficiency considerations. This interpretation also helps reconcile contradictory findings in recent AI trust literature. While some studies report a strong direct influence of trust on usage intention in AI systems, others suggest that in highly familiar or utilitarian contexts, trust exerts its influence indirectly through cognitive appraisals such as perceived usefulness or performance expectancy. In educational settings where generative AI tools are increasingly embedded in daily academic routines, trust may operate as a foundational psychological condition that shapes perception formation rather than as a

standalone predictor of actual behavior. Accordingly, the findings of this study contribute to a more differentiated understanding of trust in AI adoption by suggesting that its role may shift depending on contextual familiarity, perceived task relevance, and the normalization of AI technologies.

The results further showed that self-reported usage had a strong and significant effect on individual impact (H7 supported), indicating that students who actively used chatbots experienced higher levels of perceived personal benefit. This relationship reinforces the DeLone & McLean Information Systems Success Model, where system use is a critical precursor to realizing net benefits. In the context of chatbots, the exceptionally high path coefficient suggests that benefits—particularly in self-regulated learning and learning efficiency—are realized through active and iterative engagement rather than passive access. The more frequently and meaningfully students use the tool, the more likely they are to perceive improvements in their academic performance, confidence, and learning efficiency. This result reinforces TAM's assumption that actual system use translates cognitive perceptions (such as usefulness) into tangible outcomes—what can be termed as individual impact or realized benefits (Davis, 1987). Similar findings have been reported in AI-based learning environments, where active use of intelligent systems contributes to improved learning outcomes and user satisfaction (Memon et al., 2022).

Rather than examining platform-specific affordances, this study conceptualizes generative AI chatbots as a broader technological adoption context characterized by conversational intelligence, generative content production, and adaptive epistemic support. In contemporary higher education environments, students frequently interact with multiple AI platforms interchangeably (e.g., ChatGPT, Gemini, Copilot), often selecting tools based on convenience rather than platform-specific features. Therefore, the contribution of this study does not lie in comparing individual platforms, but in theorizing generative AI chatbots as a shared ecosystem of conversational technologies. By focusing on the underlying technological logic of generative AI rather than on individual brand-level differences, the study enhances the generalizability of TAM within rapidly evolving AI environments where platform features continuously evolve.

Theoretical Implications

This study advances the Technology Acceptance Model in the context of generative AI-based educational chatbots in three important ways.

First, rather than merely extending TAM with additional constructs, the study reconceptualizes trust within the unique epistemic characteristics of generative AI systems. Unlike traditional AI or rule-based systems, Gen-AI chatbots actively generate content, co-construct knowledge, and participate in cognitive processes through conversational interaction. In such contexts, trust does not necessarily operate as a direct behavioral driver. Instead, the findings suggest that trust functions primarily as a cognitive enabler that shapes students' perceptions of ease of use and usefulness, which subsequently influences self-reported usage behavior. This indirect role refines prior extended TAM studies that predominantly model trust as a direct predictor of behavioral intention or usage.

Second, the study introduces individual impact as an outcome construct that captures realized cognitive and academic benefits rather than mere behavioral intention. While many TAM-based studies terminate at intention or use, this research empirically demonstrates that self-reported usage frequency translates into perceived personal and academic gains. By linking usage behavior to outcome-based benefits, the study bridges technology adoption literature with learning effectiveness research in higher education.

Third, instead of focusing on a single platform (e.g., ChatGPT), this research conceptualizes generative AI chatbots as a category of conversational learning technologies. The contribution therefore lies not in comparing platform-specific affordances, but in theorizing Gen-AI chatbots as a broader technological phenomenon characterized by conversational intelligence, generative content production, and adaptive epistemic support. This approach enhances the generalizability of TAM in rapidly evolving AI ecosystems, where students interact with multiple platforms interchangeably.

Together, these contributions strengthen the theoretical positioning of TAM within contemporary Gen-AI adoption research and provide a refined understanding of how trust and perceived cognitive value shape self-reported usage and individual-level outcomes in higher education.

Practical Implications

From a practical standpoint, the findings suggest that fostering the adoption of generative AI chatbots requires a coordinated effort between technology developers and educational institutions. To translate these theoretical constructs into actionable strategies, the following distinctions are made:

For Technology Developers (Design Levers):

- **Enhancing PEU & PU:** Developers should prioritize conversational UI/UX design that minimizes the learning curve (Davis, 1989). Features such as prompt suggestions, intuitive feedback loops, and multi-modal capabilities (voice-to-text, image recognition) can directly lower cognitive barriers (PEU). Furthermore, to boost PU, developers should focus on domain-specific fine-tuning, ensuring that chatbots provide high-quality, academically relevant, and accurate content that aligns with student needs.
- **Building Trust through Transparency:** Since trust acts as a perceptual scaffold, vendors must implement "transparency by design." This includes clear disclosure of data usage policies, the use of explainable AI (XAI) to show how answers are generated, and robust privacy features to mitigate concerns regarding academic surveillance (Wu et al., 2011).

For Educational Institutions and Educators (Institutional Actions):

- **Integrating PU into Pedagogy:** Universities should move beyond passive access and actively integrate chatbots into course design. Faculty can design assignments that require "human-AI collaboration," such as using AI for initial brainstorming or code debugging, thereby demonstrating the tool's utility in achieving specific learning goals.
- **Trust and Academic Integrity:** Institutions should establish clear ethical guidelines and "AI literacy" programs. By clarifying what constitutes "fair use" versus "academic dishonesty," universities can reduce the uncertainty and "fear of penalty" that might hinder students' trust in using these tools.
- **Maximizing Individual Impact:** To turn usage into tangible outcomes, institutions should provide support services like Prompt Engineering workshops. These actions ensure that engagement is not just frequent but "meaningful," leading to realized benefits in self-regulated learning and academic efficiency (DeLone & McLean, 2003; Chan & Hu, 2023).

Conclusion

This study provides important insights into the adoption of Gen-AI based chatbots in higher education, highlighting the roles of perceived ease of use, perceived usefulness, trust, and self-reported usage in shaping students' personal benefits. While the findings advance understanding of AI-based learning tools, several limitations should be considered, which also inform directions for future research.

First, the cross-sectional survey design limits the ability to draw causal conclusions. Longitudinal studies are recommended to examine how students' perceptions, usage behaviors, and learning outcomes evolve as chatbots become more integrated into curricula. Second, the study sample was drawn exclusively from one Turkish public university, which may constrain the generalizability of the results. In addition, the use of convenience sampling may have resulted in the overrepresentation of students who are more technologically inclined or familiar with AI-based tools, potentially biasing the findings toward more favorable perceptions of chatbot usage. Cross-cultural comparative studies could provide valuable insights into how cultural and institutional differences influence adoption patterns and educational outcomes. Third, reliance on self-reported data introduces potential biases, including social desirability and recall effects. In particular, usage was measured through students' self-reported frequency of chatbot usage rather than objective system log data. While this approach is consistent with a substantial body of survey-based TAM and IS research in which behavioral use is captured through perceptual measures, self-reported usage may be subject to overestimation or response bias, potentially affecting measurement precision and construct validity. Future research could complement survey-based measures with objective usage records or system log data to enhance robustness. Additionally, mixed-method approaches, such as interviews, focus groups,

or classroom observations, could provide more nuanced and contextually grounded insights into learners' experiences, expectations, and barriers to chatbot adoption.

In addition, while this study found that trust significantly influenced perceived ease of use and perceived usefulness, its direct effect on usage was not significant. This suggests that trust primarily operates through indirect pathways rather than as a direct behavioral driver. Subsequent studies might investigate the pathways of this indirect effect by considering factors like perceived risk, privacy issues, transparency of the system, and ethical aspects. Prior literature supports this perspective: for instance, Chong et al., (2023) demonstrated that trust affects usage intentions indirectly via cognitive perceptions like usefulness and attitudes, while other studies highlight that trust in technology providers enhances perceived usefulness and ease of use, which in turn drives actual system usage (Venkatesh et al., 2012; Wu et al., 2011). Longitudinal or mixed-method studies could also investigate moderating factors such as user experience, cultural context, or prior familiarity with AI tools, providing a more comprehensive model of trust-mediated usage in AI-based educational technologies.

From a practical standpoint, institutions and developers are encouraged to enhance the usability and perceived usefulness of AI-based tools while fostering trust through transparency, ethical guidelines, and clear communication regarding data privacy. Promoting meaningful engagement with Gen-AI based chatbots can maximize the personal and academic benefits for students, supporting both learning effectiveness and long-term adoption.

CRediT Authorship Contribution Statement

M. F. Gelibolu: Conceptualization, Methodology, Formal Analysis, Data Curation, Writing – Original Draft, Writing - Reviewing & Editing, Visualization, Supervision.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics Approval and Consent to Participate

This study was approved by the Ethical Commission of Gazi University (Approval No. E-77082166-604.01-1189515). The approval was granted on 12nd March 2025, and it covers all aspects of the research involving human participants.

Declaration of AI Usage Statement

In this study, the AI tools ChatGPT (access date: 03.03.2026; Version 5.3) and Gemini (access date: 03.03.2026; Version 3.1) were used. The tools were utilized for supportive purposes only, and the scope of use was to correct spelling errors and proofreading. All content generated or suggested by AI has been reviewed for accuracy and originality by the author, who takes full responsibility. Data obtained through AI tools was reviewed in accordance with ethical and academic principles. AI was used in compliance with COPE and Kastamonu Education Journal publication policies. AI has not been listed as an author or co-author. The scientific content, accuracy, originality, and ethical responsibility of the work belong entirely to the author.

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|Research Article / Araştırma Makalesi|

Comparative Analysis of Social Studies Curricula in Türkiye (2005, 2018, 2023 and 2024)

Türkiye'de Uygulanan Sosyal Bilgiler Dersi Öğretim Programlarının Karşılaştırılması (2005, 2018, 2023 ve 2024)

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Keywords

Social studies curriculum

Skill

Value

Learning areas

Atatürkism topics

Abstract

The aim of this study is to comparatively examine the social studies curricula implemented in Türkiye following the adoption of the constructivist approach. In this context, the curricula published in 2005, 2018, 2023, and 2024 were analyzed in terms of their formal characteristics, learning areas, objectives/learning outcomes, skills, values, and topics related to Atatürkism. This study employed document analysis, one of the qualitative research methods. The data sources consisted of the relevant social studies curricula. The data were analyzed using descriptive analysis. The findings revealed both similarities and differences among the curricula across all dimensions. In particular, changes were observed in the organization of skills and values, differences emerged in the scope and content of learning areas, and variations were identified in the treatment of topics related to Atatürkism over time. The findings indicate a general tendency toward content reduction in the curricula, while skills, values, and topics related to Atatürkism have varied across different periods, and the 2024 curriculum stands out with its holistic structure. These results are expected to contribute to a better understanding of the development process of the curricula and to guide future curriculum development efforts.

Anahtar Sözcükler

Sosyal bilgiler öğretim programı

Beceri

Değer

Öğrenme alanı

Atatürkçülük konuları

Öz

Bu çalışmanın amacı, Türkiye'de yapılandırmacı yaklaşımın benimsenmesinden sonra yayımlanan sosyal bilgiler dersi öğretim programlarını karşılaştırmalı olarak incelemektir. Bu kapsamda 2005, 2018, 2023 ve 2024 programları; biçimsel özellikler, öğrenme alanları, kazanımlar/öğrenme çıktıları, beceriler, değerler ve Atatürkçülük konuları açısından analiz edilmiştir. Araştırmada nitel araştırma yöntemlerinden doküman incelemesi kullanılmıştır. Veri kaynaklarını ilgili öğretim programları oluşturmaktadır. Veriler betimsel analiz ile çözümlenmiştir. İncelenen programlar arasında tüm boyutlar açısından benzerlik ve farklılıklar belirlenmiştir. Özellikle beceri ve değer yapılarında değişimler olduğu, öğrenme alanlarının kapsam ve içerik bakımından farklılaştığı ve Atatürkçülük konularının ele alınışında dönemsel değişimler bulunduğu görülmüştür. Bulgular, programlarda genel olarak içerik azaltma eğilimi bulunduğunu; beceri, değer ve Atatürkçülük konularının dönemsel olarak değiştiğini ve 2024 programının bütüncül yapısıyla öne çıktığını göstermektedir. Bu sonuçların, programların gelişim sürecinin anlaşılmasına ve gelecekteki program geliştirme çalışmalarına katkı sağlaması beklenmektedir.

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Introduction

The social studies course is a subject that aims to educate individuals who possess decision-making skills; who love their country, nation, and humanity; who act consciously in production and consumption processes; who embrace democracy; and who are capable of multidimensional thinking (Sönmez, 2010). In the early years of the Republic, topics that fall within the scope of social studies education in Türkiye were taught through separate courses such as History, Geography, and Citizenship (formerly known as Civic Education). In the 1962 Draft Primary School Curriculum, these three subjects were brought together under the title "Community and Country Studies." Subsequently, this course was included in the 1968 Primary School Curriculum under the name "Social Studies," marking its first introduction as an independent subject at the primary school level (Öztürk, 2009).

This course was conducted predominantly through traditional approaches and methods for many years (Öztürk, 2009). From 1968 until the 2005–2006 academic year, no significant changes were made in the aims, philosophy, or teaching methods of the social studies course, and the revisions that were implemented remained largely limited to content (Sağlam & Başkan İşler, 2024).

However, since 1998, intensive curriculum development efforts have been carried out (Öztürk, 2009). Rapid changes and developments in individual, social, and economic spheres worldwide have had significant impacts in Türkiye, affecting various areas ranging from demographic and family structures to lifestyles, production and consumption patterns, as well as scientific perspectives and information technologies. Reflecting this multidimensional transformation in the education system and curricula has therefore been regarded as a necessity (Ministry of National Education [MoNE], 2005a). Accordingly, the need for a new instructional approach capable of addressing changing social and individual demands has increased.

The need for students to solve the problems they encounter in their daily lives and to adapt to change has made it necessary to adopt a learner-centered approach (Sağlam & Bilgili, 2006). Accordingly, the constructivist approach, which is based on enabling students to learn how to use knowledge rather than merely memorizing it and to construct new knowledge upon their existing knowledge, began to be adopted in the education system (Kaya et al., 2014). In this context, the primary education curriculum drafts prepared by the MoNE were piloted in the 2004–2005 academic year and were implemented in all schools starting from the 2005–2006 academic year (Sağlam & Başkan İşler, 2024). During this process, the social studies curriculum (SSC) was also restructured based on the social constructivist approach, emphasizing thematic learning, problem solving, and cooperative learning (Öztürk, 2009). Thus, the SSC was developed in line with the constructivist perspective, taking into account both global changes and the needs identified through the evaluation of previous curricula (MoNE, 2005b).

The 2005 social studies curriculum [2005 SSC] aimed to educate active citizens by equipping students with the skills, concepts, and values they need in the processes of knowledge production and effective use of knowledge (Ata, 2009). This curriculum remained in effect for many years and constituted the fundamental framework of social studies education in Türkiye. However, over time, developments in the field of education and feedback obtained from practice led to the need to review the curriculum. In this context, the SSC was further updated in 2015, 2017, and 2018.

During the development process of the 2018 social studies curriculum [2018 SSC], curricula that had been renewed in different countries based on similar rationales were examined, and academic studies on education and curricula conducted both nationally and internationally were reviewed. In addition, relevant legislation, development plans, council decisions, and reports prepared by various institutions were analyzed; and the views of teachers, administrators, and academics were evaluated through surveys and reports. In line with the opinions and evaluations obtained, the curricula were reviewed and put into practice in all schools as of the 2018–2019 academic year (MoNE, 2018).

The SSC, which was updated in 2018, was later reviewed again in 2023 with some limited revisions. In the 2023 update, no significant changes were made to the overall structure of the curriculum; rather, only minor modifications were introduced in the wording and content of certain attainments (MoNE, 2023). Therefore, the 2018 SSC and 2023 social studies curriculum [2023 SSC] largely share similar characteristics.

The process of updating curricula in Türkiye continued after 2023, and accordingly, the SSC was restructured in 2024 within the framework of the Century of Türkiye Education Model (CTEM). In the development of the 2024 Social Studies Curriculum [2024 SSC], a holistic educational approach was adopted to support students' multidimensional development in line with changing and evolving global conditions. Within the curriculum, conceptual skills, domain-specific skills, social-emotional learning skills, values, tendencies, and various literacy skills were addressed together, aiming to equip students with the competencies they need in both individual and social life. Furthermore, considering the interdisciplinary nature of the social sciences, the curriculum content was organized within the context of change and continuity from past to present, and a structure was established in which learning outcomes were integrated with skills (MoNE, 2024).

When the social studies curricula [SSCs] implemented in Türkiye are examined, it is seen that the structure of the curricula does not consist solely of content arrangements; rather, it has a multidimensional structure encompassing various components such as learning domains, attainments/learning outcomes, skills, values, and topics related to Atatürkism. Learning domains are defined as a fundamental structure that enables the topics and themes addressed in social studies education to be viewed holistically and that organizes the learning process (MoNE, 2005a). Attainments or learning outcomes refer to the desired knowledge, skills, attitudes, and values that students are expected to acquire through planned or structured learning experiences (Tarhan, 2014). Skills, on the other hand, are defined as the abilities that students are expected to acquire, develop, and use by relating them to daily life during the learning process, and that are necessary for performing a task or addressing a subject (Ata, 2009; Bilgili, 2009). In this respect, skills are considered an important component of the curriculum as they contribute to the development of higher-order cognitive processes such as critical thinking, problem solving, and decision making. The concept of value is expressed as a set of beliefs that guide individuals' behaviors and distinguish humans from other living beings (Ulusoy & Dilmaç, 2012). In this context, the values included in SSCs are among the fundamental elements that support the development of individuals as responsible, democratic, and sensitive citizens in social life. In addition, topics related to Atatürkism are also included in SSCs in Türkiye as an important dimension of history and citizenship education. Through the teaching of Atatürkism, it is aimed to educate individuals who understand and adopt Atatürk's principles and reforms (Dönmez & Yazıcı, 2008). Therefore, addressing these dimensions together provides an important framework for understanding the structural characteristics of SSCs and their changes over time.

When the literature is examined, it is seen that there are numerous studies comparing SSCs across different years and dimensions. In a significant portion of these studies, curricula have been analyzed in terms of fundamental components such as learning domains, attainments/learning outcomes, skills, values, and topics related to Atatürkism, and similarities and differences among curricula have been identified.

In this context, the study conducted by Semenderoğlu and Gülersoy (2005) compared the 1968 and 2005 SSCs, evaluating them in terms of various aspects such as specific objectives, units, and the number of topics/attainments. The findings revealed that the 2005 curriculum had both strengths and aspects requiring improvement. Similarly, Bekdemir and Polat (2016) compared the 2005 curriculum with the draft curriculum published in 2015 and found that the newer program adopted a more simplified structure by reducing general objectives, learning domains, and the number of attainments.

Another study comparing curricula in terms of their core components was conducted by Çoban and Akşit (2018). In this study, the 2005 and 2017 curricula were examined in terms of learning domains, skills, values, concepts, attainments, and Atatürkism. The findings indicated that learning domains were reorganized in the 2017 curriculum and that a new learning domain titled "Active Citizenship" was introduced. While the number of skills increased, the number of values and attainments decreased. In addition, it was determined that attainments related to Atatürkism were significantly reduced.

In the study conducted by Eker (2020), the 2005 and 2018 curricula were compared in terms of objectives, learning domains, instructional approaches, attainments, skills, values, and assessment and evaluation. The findings showed that in the 2018 curriculum, the number of learning domains was reduced, skills were increased, and values were associated with learning domains. Furthermore, the curriculum was

structured in a more simplified way, the number of attainments decreased, and some Atatürkism-related content present in the 2005 curriculum was removed.

More recent studies have focused on the comparison of the 2018, 2023, and 2024 curricula. Önger and Duman (2024) examined these curricula in terms of formal structure, content organization, educational process, and assessment and evaluation, concluding that while the 2018 and 2023 curricula are largely similar, the 2024 curriculum presents a more holistic and systematic structure. Similarly, Yıldırım and Çalışkan (2024) reported that the 2024 curriculum differs from previous curricula in terms of skills, values, concepts, and learning domains.

Dinç et al. (2024) compared the 2018 and 2024 curricula and found that in the 2024 curriculum, the number of learning domains and attainments was reduced, structural changes were introduced, and literacy skills were brought to the forefront. Likewise, Turan et al. (2025) compared the 2024 curriculum with the 2005 and 2017 curricula and emphasized that the new curriculum exhibits a more integrated structure in terms of learning domains, learning outcomes, skills and values education, and assessment and evaluation.

However, it is noteworthy that a significant portion of the studies in the literature have been conducted based on specific curricula or limited dimensions. Although these studies provide valuable insights into various aspects of the curricula, it can be argued that comprehensive comparative studies addressing the changes in SSCs over time from a multidimensional and holistic perspective remain limited. This situation indicates the need for more comprehensive analyses that examine the relationships among the fundamental components of curricula.

The aim of this study is to examine the 2005, 2018, 2023, and 2024 SSCs developed in Türkiye within the framework of the constructivist approach, in terms of their formal characteristics, learning domains, attainments/learning outcomes, skills, values, and topics related to Atatürkism, and to reveal the similarities and differences among these curricula. These dimensions were included in the scope of the study as they constitute the core components of SSCs and reflect the objectives, content, and value dimensions of the curriculum. Accordingly, these dimensions were determined as the analytical framework in order to reveal the structural characteristics of the curricula, as well as the change and continuity among them over time. In line with this general aim, the study seeks to answer the following research questions regarding the SSCs prepared by the MoNE in 2005, 2018, 2023, and 2024:

- What are the similarities and differences in terms of formal characteristics?
- What are the similarities and differences in terms of learning domains?
- What are the similarities and differences in terms of attainments/learning outcomes?
- What are the similarities and differences in terms of skills?
- What are the similarities and differences in terms of values?
- What are the similarities and differences in terms of topics related to Atatürkism?

This study is limited to the examination of the SSCs published in Türkiye through comparative document analysis. Within the scope of the research, only the SSCs published in 2005, 2018, 2023, and 2024 were included, and these curricula were compared in terms of formal characteristics, learning domains, attainments/learning outcomes, skills, values, and topics related to Atatürkism. The analysis conducted in this study was restricted solely to the relevant curriculum documents, and other data collection methods or stakeholder perspectives were excluded from the scope of the research.

Method

Research Design

This study is a qualitative research project that aims to examine and evaluate the 2005, 2018, 2023, and 2024 SSCs developed in Türkiye based on the constructivist approach. Qualitative research is an interpretive research method that relies on multiple subjective data types and allows for the investigation of events and phenomena in their natural settings (Christensen et al., 2020). In accordance with the study's aim,

the research was carried out using a document analysis design, one of the qualitative research methods. Document analysis is a data collection method based on the examination of existing records and documents (Karasar, 2010) and a research approach that involves the systematic examination and interpretation of written and visual materials related to the research topic (Sönmez & Alacapınar, 2014).

Data Sources

In this study, criterion sampling, a purposeful sampling method, was employed. Criterion sampling involves selecting all cases that meet a set of predefined criteria (Patton, 2018; Yıldırım & Şimşek, 2008). The criterion for this research was defined as SSCs in Türkiye based on the constructivist approach and published by the MoNE. Table 1 presents information about the SSCs that constitute the data sources of this study.

Table 1

Data Sources of the Study

Full Title of the Curriculum	Year of Publication	Publishing Institution
Social studies curriculum for Grades 4–5	2005	Ministry of National Education, Board of Education
Social studies curriculum for Grades 6-7	2005	Ministry of National Education, Board of Education
Social studies curriculum (Primary and Lower Secondary Schools, Grades 4, 5, 6, and 7)	2018	Ministry of National Education, Board of Education
Social studies curriculum (Primary and Lower Secondary Schools, Grades 4, 5, 6, and 7)	2023	Ministry of National Education, Board of Education
Social studies curriculum (Primary and Lower Secondary Schools, Grades 4, 5, 6, and 7) Century of Türkiye Education Model	2024	Ministry of National Education, Board of Education

The table presents information about the SSCs used as data sources in this study. The curricula examined were published by the Ministry of National Education.

Data Collection and Analysis

Data Collection

In qualitative research, data may be collected through document review, observation of behaviors, or interviews with participants (Cresswell, 2013). In accordance with the purpose of this study, the document review technique was employed, which involves the analysis of written documents that contain information about the phenomena or situations under investigation (Sönmez & Alacapınar, 2014). Document review enables researchers to systematically analyze existing printed or electronic materials to answer the research questions (Bowen, 2009).

During the document analysis process, the procedural steps suggested by Yıldırım and Şimşek (2008) were followed. First, in the stage of accessing the documents, the SSCs published in 2005, 2018, 2023, and 2024 by the Ministry of National Education were obtained from the official website (MoNE, 2018; MoNE, 2023; MoNE, 2024) of the Board of Education and the researchers' personal archives. Second, in the stage of verifying authenticity, it was confirmed that the obtained documents were official curriculum documents published by authorized institutions. In the third stage, which involves understanding the documents, the curriculum texts were read in detail and examined in line with the aim of the study. In the fourth stage, the data were analyzed, and the curricula were comparatively evaluated in terms of learning outcomes, learning domains, skills, values, and topics related to Atatürkism. Finally, in the stage of using the data, the findings were organized according to the research questions and presented and interpreted through tables and explanatory texts. The fact that the documents were obtained from official sources provided an important assurance regarding the authenticity of the data.

Data Analysis

In this study, the documents were analyzed within the framework of predetermined categories. The categories used in the analysis included formal characteristics, learning domains, learning outcomes, skills, values, and topics related to Atatürkism.

Each document was first analyzed separately according to these categories and then compared across the different curriculum versions. The data were analyzed using the descriptive analysis approach, in which the findings are summarized and interpreted based on previously defined themes (Yıldırım & Şimşek, 2008). In this approach, the data are presented as they are, interpreted within thematic contexts, and systematically categorized.

The descriptive analysis process was carried out in accordance with the four stages proposed by Yıldırım and Şimşek (2008). In the first stage, which involves establishing a framework for descriptive analysis, the themes for analysis were determined in line with the aim and research questions of the study. Within this framework, the curricula were examined in terms of formal characteristics, learning domains, learning outcomes, skills, values, and topics related to Atatürkism. In the second stage, which involves processing the data according to the thematic framework, the examined curricula were analyzed in detail based on the predetermined themes, and the relevant data were organized under these themes. In the third stage, the identification of findings, the obtained data were systematically presented through tables and explanatory texts. In the final stage, the interpretation of findings, the results were evaluated in accordance with the research questions, and the similarities and differences among the curricula were identified.

To ensure the reliability of the study, the analysis process was conducted independently by two field experts. The categorizations made by the researchers were compared, and any discrepancies were discussed until consensus was reached. This procedure aimed to minimize interpretation differences during the analysis process and to enhance the consistency of the findings.

Findings

The findings obtained from the analyzed documents are presented in accordance with the research questions and the predetermined categories, and are organized under specific thematic headings. In this context, the findings were discussed under the headings of formal characteristics, learning domains, attainments/learning outcomes, skills, values, and topics related to Atatürkism.

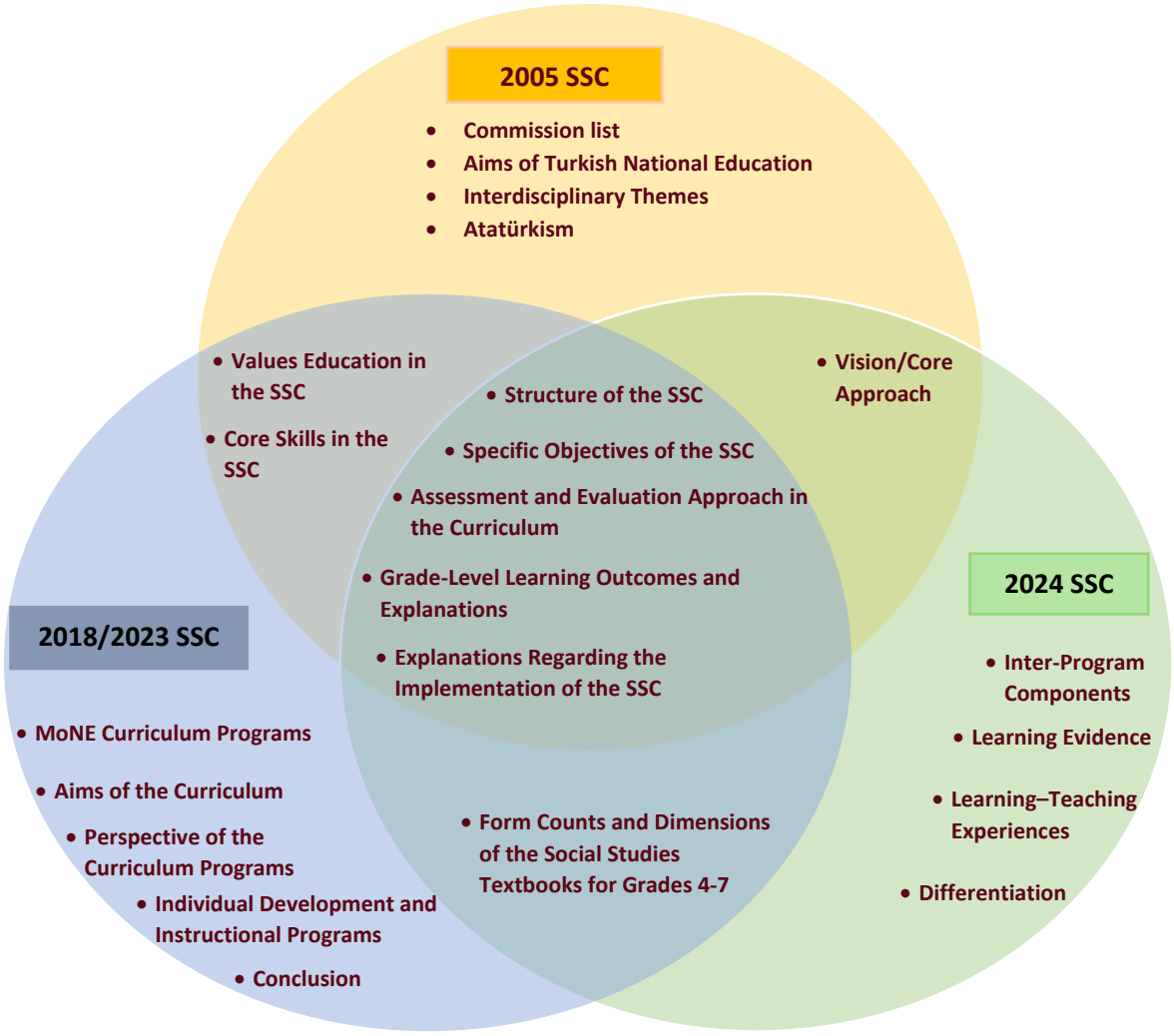
During the analysis process, the 2018 and 2023 SSCs were evaluated together, as they were found to be largely similar across the defined categories. This section presents the descriptive analysis results for each category and provides a comparative overview of the elements of change and continuity among the

Findings on the Formal Characteristics of the Curricula

When examined in terms of formal characteristics, both similarities and differences were identified among the SSCs included in the study. The comparison of the formal characteristics of the 2005, 2018/2023, and 2024 SSCs, all of which were prepared based on the constructivist approach, is presented in Figure 1.

Figure 1

A Comparison of the SSCs in Terms of Formal Features



An analysis of Figure 1 reveals both similarities and differences among the formal structures of the 2005, 2018/2023, and 2024 SSCs The curriculum commission list, "Aims of Turkish National Education," and "Interdisciplinary Themes" sections included in the 2005 SSC were not carried over into the later versions (2018/2023 and 2024).

In the 2005 SSC, course achievements were aligned with interdisciplinary outcomes, whereas in the 2024 SSC, a similar integration appears under the "Interdisciplinary Connections" section in the "Learning Areas by Grade Level" part of the SSC. This indicates that the 2024 program structures interdisciplinary connections through a more thematic approach.

The "Atatürkism" section included in the 2005 SSC was removed from the 2018/2023 and 2024 curricula. Additionally, the "General Objectives" section of the 2005 SSC was renamed in later programs: as "Specific Objectives of the Social Studies Curriculum" in the 2018/2023 SSC and as "Fundamental Philosophy and Specific Objectives of the Social Studies Course" in the 2024 SSC.

The assessment and evaluation components also show notable differences across curricula. In the 2005 SSC, a dedicated section for assessment and measurement tools with detailed implementation examples was included. In contrast, the 2018/2023 SSC addressed this component more briefly, omitting example tools. In the 2024 SSC, this area is presented under the title "Learning Evidence (Assessment and Evaluation)," which provides teachers with activity suggestions for each learning outcome.

Implementation guidelines for each SSC are also presented under different section titles. In the 2005 SSC, this section was titled "Explanations Regarding the Implementation of the SSC"; in the 2018/2023 SSC, it appeared as "Points to Consider During the Implementation of the SSC"; and in the 2024 SSC, it was titled "Principles for the Implementation of the SSC." On the other hand, sections such as "Objectives of the

Curriculum," "Perspective of the Curriculum," "Individual Development and Instructional Programs," and "Conclusion" are included only in the 2018/2023 SSCs and do not appear in the others.

The "Structure of the Program" section of the 2005 SSC is quite comprehensive in terms of skills, values, and concepts. This section provides detailed information on the definitions of skills, sub-skills, sample activities for skill instruction, approaches and activities for values education, concept teaching techniques, and concept lists.

In the 2018/2023 SSCs, the section titled "Structure of the Social Studies Curriculum" focuses only on learning areas, while "Basic Skills" and "Values Education" are presented as separate components. However, there is no dedicated section for concept teaching in these versions.

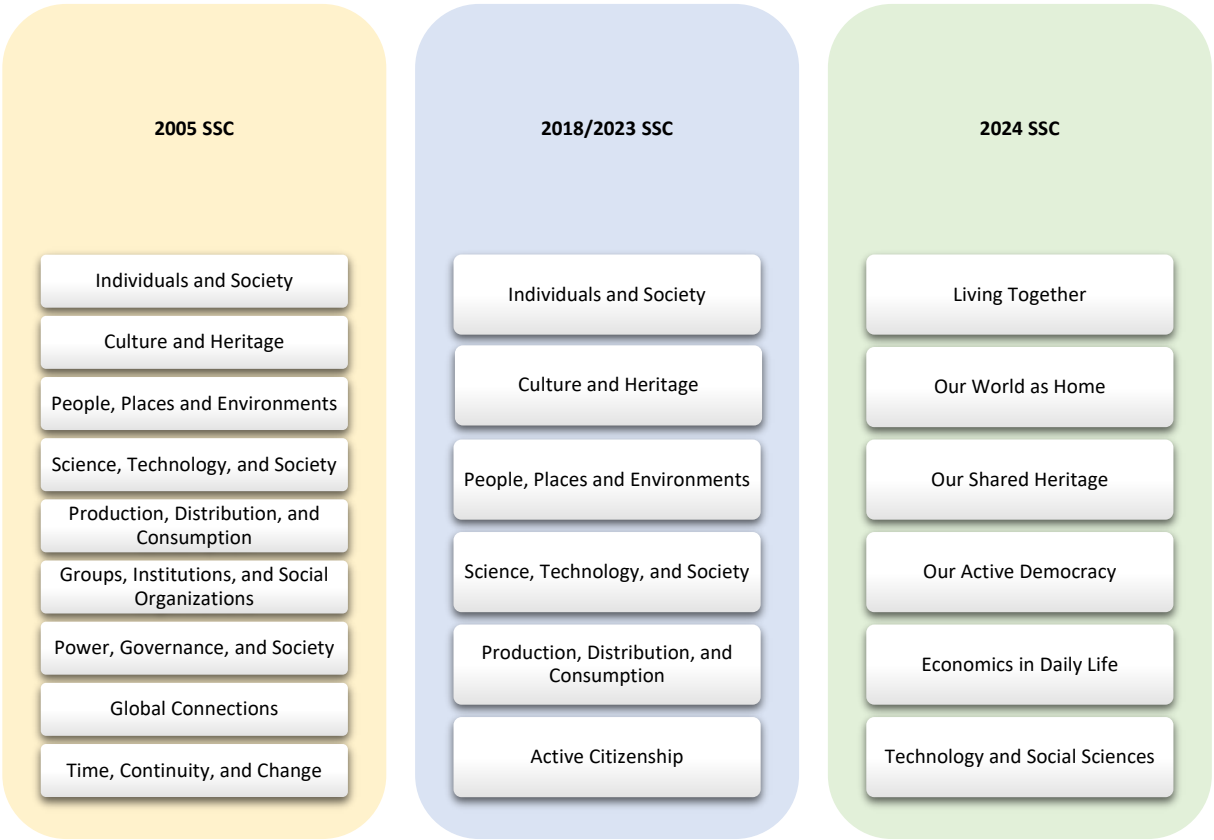
In the 2024 SSC, skills and values are addressed under the "Inter-Program Components" (social-emotional learning skills, values, and literacy skills). Unlike previous programs, the skills are not listed item by item but are categorically presented in the "Learning Areas by Grade Level" section. In this section, the target values and key concepts to be taught are specified, along with the inclusion of dispositions within the same framework. Suggestions for teaching skills, values, concepts, and dispositions are provided to teachers in the "Learning–Teaching Experiences" section.

Findings on Learning Areas

A learning area can be defined as a structure in which interrelated skills, themes, concepts, and values are addressed holistically, and the learning process is organized around these elements (MoNE, 2023). In this context, a comparative visual showing the similarities and differences among the learning areas in the examined curricula is presented in Figure 2.

Figure 2

A Comparison of the Learning Areas in the SSCs



When Figure 2 is examined, it is observed that the number of learning areas has decreased in the curricula under review, suggesting an effort to streamline the content of the Social Studies course. The 2005 SSC included nine learning areas. In this program, the "Time, Continuity and Change" learning area was

integrated into other learning areas and units, and did not contain standalone attainments. In addition, in the 2005 SSC, unit titles were included alongside learning domains.

In the 2018/2023 SSC, the number of learning areas was reduced to seven. The learning areas “Groups, Institutions and Social Organizations” and “Power, Governance and Society” from the 2005 curriculum were replaced with a new learning area titled “Active Citizenship.” In addition, unit titles were not included in the 2018 and 2023 SSCs.

In the 2024 SSC, the number of learning domains was reduced to six, and unit titles were again not included. Additionally, the program introduced a “School-Based Planning” process to allow for the implementation of extra-curricular activities such as research, reading exercises, social activities, out-of-school learning experiences, observations, and local studies, in addition to the five weekly class hours per grade level. This indicates the adoption of a more flexible structure that encourages schools to incorporate learning experiences based on their local and environmental resources.

Findings on Attainments/Learning Outcomes in the Curricula

In the 2005 and 2018/2023 SSCs, the term " attainment" was used, whereas in the 2024 SSC, this has been replaced by the expressions "learning outcomes" and "process components". The findings regarding the comparison of the 2005, 2018/2023, and 2024 SSCs in terms of learning outcomes and process components—developed based on the constructivist approach—are presented in Table 2.

Table 2

Comparison of the Number of Attainments/Learning Outcomes in the SSC

Grade Level	Number of Achievements / Learning Outcomes		
	2005 SSC	2018/2023 SSC	2024 SSC
4th Grade	46	33	17
5th Grade	46	33	19
6th Grade	43	34	18
7th Grade	39	31	17
Total	174	131	71

As seen in Table 2, the number of attainments provided at each grade level tends to decrease with each newly published curriculum. This indicates a trend toward content simplification within the SSCs.

In the 2024 SSC, the term "attainment" was replaced by the concepts of "learning outcomes and process components," which describe the processes related to the knowledge and skills students acquire through their learning experiences. The number of learning outcomes included in this program is significantly lower than the number of attainments in previous curricula. However, the structure of learning outcomes and process components in the 2024 SSC aligns more closely with the principles of the constructivist approach compared to its predecessors.

The 2024 SSC was designed with an approach that accommodates different learning styles and student characteristics. Accordingly, the curriculum aims to enable students to provide examples from daily life related to the topics, explain and interpret the knowledge they acquire in their own words, engage in activities based on observation and experience, and employ higher-order thinking skills throughout the learning process.

Findings Regarding Skills

In the 2005 SSC, skills were categorized into two groups as domain-specific skills (6 skills) and basic skills (9 skills), and each skill was explained in detail together with its subcomponents. In the 2018 and 2023 SSCs, however, skills were presented without any classification and were listed in a simple format. In the 2024 SSC, prepared within the framework of the CTEM, the skills aimed to be developed in students were organized into four main categories: “Domain-Specific Skills,” “Conceptual Skills,” “Social-Emotional Learning Skills,” and “Literacy Skills.” In addition, tendencies aimed at supporting students’ attitudes and behaviors in the learning process were also included in the curriculum. Among these, domain-specific skills are structured in accordance with the nature of the social studies discipline and aim to develop students’ integrated

knowledge and skills in areas such as history, geography, citizenship, and economics. Conceptual skills are integrated skills consisting of observable basic skills, mental processes requiring abstract thinking, and higher-order cognitive abilities used in performing complex actions. Social-emotional learning skills encompass the knowledge, skills, and tendencies that enable individuals to manage their emotions, develop empathy, establish healthy and supportive relationships, and build a strong sense of self. Literacy skills, on the other hand, include competencies that enable students to recognize change, adapt to new situations, and apply innovations emerging with advancing technologies to their daily lives (MoNE, 2024). Table 3 presents the information on the skills included in the SSCs developed based on the constructivist approach.

Table 3.

Findings on the skills included in the SSCs

	2005 SSC		2018/2023 SSC		2024 SSC	
Skills	**Skills**	**Skills**	**Domain Skills**	**Conceptual Skills**	**Social and Emotional Learning Skills**	**Literacy Skills**
Research	✓	✓				
Using Information Technologies	✓					
Collecting Information				✓		
Information Literacy						✓
Scientific Inquiry			✓			
Geographical Inquiry			✓			
Environmental Literacy		✓				
Inference				✓		
Analysis				✓		
Perceiving Change and Continuity	✓	✓	✓			
Digital Literacy		✓				✓
Critical Thinking	✓	✓		✓		
Empathy	✓	✓				
Flexibility					✓	
Financial Literacy		✓				✓
Generalization				✓		
Entrepreneurship	✓	✓	✓			
Visual Literacy						✓
Observation	✓	✓				
Map Literacy		✓	✓			
Legal Literacy		✓				
Communication	✓	✓			✓	
Collaboration		✓			✓	
Recognizing Stereotypes and Bias		✓				
Decision Making	✓	✓		✓		
Using Evidence		✓	✓			
Comparison				✓		
Self-Adaptation					✓	

Self-Regulation					✓	
Self-Awareness					✓	
Location Analysis		✓				
Cultural Literacy						✓
Media Literacy		✓				
Spatial Perception	✓	✓	✓			
Self-Control		✓				
Summarizing				✓		
Political Literacy		✓				
Problem Solving	✓	✓		✓		
Art Literacy						✓
Classification				✓		
Inquiry				✓		
Responsible Decision Making					✓	
Social Awareness					✓	
Social Participation	✓	✓	✓			
Sustainability Literacy						✓
Drawing and Interpreting Tables, Graphs, and Diagrams		✓	✓			
Historical Empathy			✓			
Discussion				✓		
Deductive Reasoning				✓		
Using Turkish Correctly, Beautifully and Effectively	✓	✓				
Adaptability					✓	
Civic Literacy						✓
Data Literacy						✓
Reflection				✓		
Structuring				✓		
Creative Thinking	✓	✓				
Interpretation				✓		
Understanding Time and Chronology	✓	✓	✓			
TOTAL	**15**	**27**	**11**	**16**	**9**	**9**

When Table 3 is examined, it can be observed that there has been an increase in the number of skills across the curricula. In addition, some terminological changes in the names of certain skills are noticeable. For instance, the skill referred to as “Creative Thinking” in the 2005 SSC was expressed as “Innovative Thinking Skill” in the 2018 and 2023 curricula. Similarly, the skill “Map Literacy” included in the 2018 and 2023 curricula was renamed as “Map Skill” in the 2024 curriculum. Moreover, the skill “Using Evidence” in the 2018 and 2023 curricula was redefined as “Evidence-Based Inquiry and Research Skill” in the 2024 curriculum. Likewise, the skill “Perceiving Space” included in the 2005 and 2018/2023 curricula was presented as “Spatial Thinking Skill” in the 2024 curriculum, while the skill “Drawing and Interpreting Tables, Graphs, and Diagrams” was expressed as “Table, Graph, Figure, and/or Diagram Skill.” Similarly, the skill “Perceiving Time and Chronology,” which appeared in the 2005 and 2018/2023 curricula, was included in the “Relationships Between Skills” section of the 2024 curriculum under the title “Perceiving Time and Chronological Thinking.” These changes indicate that skills have been restructured across the curricula and presented with more comprehensive and varied expressions.

Within the learning domain titled "Technology and Social Sciences" at the 7th-grade level in the 2024 SSC, the skill "Scientific Inquiry," which is among the domain-specific skills of science education, was also included. This indicates that an approach integrating skills from different disciplines has been adopted in the SSC and that the program places greater emphasis on interdisciplinary relationships. These changes suggest that the skills have been redefined not only in terms of terminology but also in terms of meaning and scope.

Unlike these programs, the 2024 SSC organizes skills within a structure that integrates them with dispositions and values within the framework of the CTEM. Through this approach, the curriculum aims to support students' multidimensional development and strengthen their ability to connect learning with everyday life. The program encourages students to experience and apply the skills they will need by relating them to real-life contexts.

Findings Regarding Values

The social studies course aims to help students internalize democratic values and adapt effectively to the society in which they live as individuals who are aware of their rights and responsibilities. Accordingly, the primary objective of the course is to ensure that students are equipped to transform the knowledge and skills they acquire into real-life practices.

This approach is based on the constructivist principle that "learning occurs through experience." Therefore, in SSCs, values are not only treated as content to be taught but also as a learning component that supports students' active participation in social life (MoNE, 2005b). Findings related to the values in SSCS, which are designed with a constructivist approach, are presented in Figure 3.

Figure 3

Findings Regarding the Values Included in the SSCs

As seen in Figure 3, it has been determined that the values included in the SSCs, prepared according to the constructivist approach, have changed over time. While some values remained consistent across various curriculum versions from different years, others were removed and later reintroduced.

One fundamental element that should not be overlooked in designing learning experiences is the integration of value education into the process in alignment with curriculum content. Students can internalize values only through experiences that enable them to develop attitudes and behaviors consistent with those values. In this regard, it is essential to support participatory classroom environments based on values with the overall school culture (MoNE, 2025). For values education to be effective, appropriate pedagogical approaches and supportive learning environments need to be structured in an integrated manner (Berkowitz, 2011).

To enhance the effectiveness of value education, it is recommended to use alternative teaching approaches when appropriate. In transferring values to students meaningfully, pedagogical use of examples from national and spiritual cultural heritage, as well as historical figures, is encouraged. Additionally, both in-school and out-of-school learning environments should be incorporated into the process to allow students to observe and experience value-oriented practices (MoNE, 2025). The number of values included in the Social Studies course varies across the examined curricula. Specifically, the 2005 SSC includes 20 values, the 2018 and 2023 curricula include 18 values, and the 2024 curriculum again includes 20 values.

An examination of the curricula reveals that some terminological changes have been made in the expressions of certain values. For instance, the value expressed as “being fair” in the 2005 SSC was presented as “justice” in the 2018 and 2023 curricula. Similarly, the value referred to as “giving importance to family unity” in the 2005 and 2018/2023 curricula was reformulated as “family integrity” in the 2024 curriculum. In addition, the value “giving importance to being healthy” included in the 2005 curriculum was expressed as “healthy living” in the 2024 curriculum. Furthermore, the value “independence,” which appeared among the values in the 2005 and 2018/2023 curricula, was not presented directly as a value in the 2024 curriculum; instead, it was addressed under the heading of “dispositions. These shifts indicate that some values in the 2024 curriculum have been reframed with a focus on behavioral aspects, transforming them into a dynamic structure by integrating them with tendencies.

Findings Regarding Atatürkism-Related Topics in the Curricula

In the 2005 SSC, topics related to Atatürkism are presented together with their explanations and are associated with the relevant learning outcomes. In this context, topics related to Atatürkism are addressed in connection with different learning domains across various grade levels. Accordingly, Atatürkism-related learning outcomes are included in the Culture and Heritage and Science, Technology and Society learning domains in Grade 4; in the Culture and Heritage, Global Connections, and Power, Governance and Society learning domains in Grade 5; in the Individual and Society, People, Places and Environments, Culture and Heritage, Production, Distribution and Consumption, Global Connections, Power, Governance and Society, and Science, Technology and Society learning domains in Grade 6; and in the Individual and Society, Global Connections, and Power, Governance and Society learning domains in Grade 7 (MoNE, 2005a). This indicates that topics related to Atatürkism are integrated into different learning domains of the curriculum in order to contribute to the development of students’ historical awareness, social understanding, and citizenship consciousness.

In the 2018 and 2023 SSCs, direct references to Atatürk were included to a more limited extent. In these curricula, Atatürk is mentioned only in the learning outcome “Explains Atatürk’s contributions to the development of Turkish democracy,” which is included in the Grade 7 learning domain *Active Citizenship*, and in the statement found in the section on the specific objectives of the curriculum: “to comprehend the role of Atatürk’s principles and reforms in the social, cultural, and economic development of the Republic of Türkiye and to be willing to sustain democratic, secular, national, and modern values.” This situation indicates that the scope of Atatürkism in the 2018 and 2023 curricula has been narrowed and that it has been addressed mainly within the framework of democratic citizenship and values education.

In the 2024 SSC, it is observed that the theme of Atatürkism is addressed both at the level of specific objectives and within the learning domains. In the section titled *“The Fundamental Philosophy and Specific Objectives of the Social Studies Course”*, the curriculum includes the statement: “to draw conclusions about

the importance of national unity by referring to the sacrifices and solidarity demonstrated by Atatürk and the Turkish nation during the establishment of the Republic of Türkiye."

Additionally, in the *"Our Living Democracy"* learning domain at the 4th and 7th grade levels, emphasis is placed on Atatürk's democratic leadership, his understanding of national unity, and the values of the republic. In this respect, the 2024 SSC appears to have strengthened the theme of Atatürkism and addressed it in a way that is integrated with contemporary citizenship education.

Discussion

When the 2005, 2018/2023, and 2024 SSCs developed in Türkiye based on the constructivist approach are compared in terms of formal characteristics, it is observed that there are some fundamental differences. It was determined that the 2005 SSC was prepared with a highly detailed structure; in contrast, the 2018 and 2023 SSCs exhibit largely similar characteristics, and the detailed structure of the 2005 curriculum was replaced by a more simplified program structure. In the 2024 SSC, although a simplification is observed in terms of the number of learning domains and attainments, it is noteworthy that a more comprehensive structure was adopted in terms of explanations regarding the implementation of the curriculum. In this context, it is seen that new sections such as cross-curricular components, learning-teaching experiences, and differentiation were included in the curriculum. Furthermore, while the curriculum components in the 2005, 2018, and 2023 SSCs were presented in list form under separate headings, in the 2024 SSC these components were integrated and presented in relation to learning domains within a holistic structure.

These findings are also consistent with studies in the literature. Eker (2020), for instance, stated that the 2018 SSC has a more simplified structure compared to the 2005 SSC. Similarly, Önger and Duman (2024) reported that the 2018 and 2023 curricula share largely similar characteristics. Dinç et al. (2024) also emphasized that there are formal differences between the 2018 and 2024 SSCs, particularly highlighting that in the 2024 curriculum, program components are presented in a more integrated manner and in relation to learning domains. The way in which curriculum components are presented indicates a shift in the 2024 SSC from a fragmented structure toward a more systematic and relational framework.

However, it is noteworthy that the detailed and example-based explanations provided in sections such as learning-teaching processes, evidence of learning, and differentiation in the 2024 SSC show similarities with the 2005 SSC—the first curriculum prepared in line with the constructivist approach—in terms of including comprehensive explanations. This can be considered a factor that may enhance the functionality of the curriculum in guiding teachers. Indeed, Kalaycı and Baysal (2020) stated that the 2005 SSC was more adequate in terms of providing guidance to teachers compared to the 2017 and 2018 curricula. Similarly, Ocak and Kocaman (2021) evaluated the absence of explanations in the 2018 curriculum—particularly regarding how each attainment should be assessed and how the learning-teaching process should be conducted—as a shortcoming of the program. Dallı and Hamarat (2025) also indicated in their study that the 2024 SSC has the potential to guide teachers.

These findings are largely consistent with the existing literature and demonstrate that the current transformation is also supported by previous studies. Consequently, although the 2024 SSC maintains the trend toward a simplified structure that began with earlier curricula, it can be argued that it adopts a hybrid structure by strengthening teacher-guiding explanations. This hybrid structure offers a more balanced approach compared to previous curricula, as it both sustains the simplified curriculum model and reinforces guiding elements for teachers. This situation indicates that curricula over time have been restructured not only in terms of content but also in terms of usability and practical applicability.

When the 2005, 2018/2023, and 2024 SSCs developed in Türkiye based on the constructivist approach are compared in terms of learning domains, it is observed that each new curriculum reflects a trend toward simplification in the number of learning domains. It is observed that while the 2005 SSC included a total of nine learning areas that varied depending on grade levels, the 2018/2023 curriculum was structured around seven learning areas that are common to all grade levels and defined with the same titles. In the 2024 SSC,

the number of learning domains was reduced to six, and a consistent structure was maintained across all grade levels.

In addition, changes were made not only in the number but also in the naming of learning domains; learning domains that were largely presented with similar titles in the 2005 and 2018/2023 SSCs were reorganized under different names in the 2024 SSC. Furthermore, it is observed that the unit structure presented together with learning domains in the 2005 SSC is not included in the 2018/2023 and 2024 SSCs. Another notable innovation in the 2024 SSC is the allocation of five class hours at each grade level within the scope of "school-based planning." This innovation is considered likely to enhance the functionality and efficiency of the course.

Similar to learning domains, a gradual decrease in the number of attainments/learning outcomes across the SSCs was also identified. While the 2005 SSC included a total of 174 attainments, this number decreased to 131 in the 2018/2023 SSCs. In the 2024 SSC, the term "attainment" was replaced with the more holistic, process- and learner-oriented expression "learning outcomes and process components," and a total of 71 learning outcomes were included in the curriculum.

These findings are consistent with studies in the literature. Çoban and Akşit (2018), in their comparison of the 2005 and 2017 SSCs, reported that there was no substantial change in learning domains, but a decrease in the number of attainments. Similarly, Eker (2020) and Öztürk and Kafadar (2020) stated that the number of learning domains in the 2018 SSC decreased compared to the 2005 SSC. In line with these findings, Dinç et al. (2024), Gürler and Gürgen (2025) and Kan and Çevik (2025) emphasized that both the number of learning domains and attainments in the 2024 SSC decreased compared to the 2018 SSC. Other studies have also concluded that there is a reduction in the number of learning domains and attainments in the 2024 SSC compared to previous curricula (Dallı & Hamarat, 2025; Turan et al., 2025; Yıldırım & Çalışkan, 2024). The notable decrease in attainments/learning outcomes observed in the 2018/2023 and 2024 SSCs may be associated with addressing the negative criticisms expressed by teachers and academics regarding the excessive number of topics and attainments (Altay, 2020; Karadeniz et al., 2015; Memişoğlu & Köylü, 2015).

However, there are also studies indicating that despite the reduction in learning domains and attainments in the 2018 SSC, the content remains dense (Altay, 2020; Taş & Kıroğlu, 2018). This situation may be related to the insufficiency of instructional time. Indeed, studies by Taş and Kıroğlu (2018), Çelikkaya and Kürümlüoğlu (2018), and Çeliktaş and Sönmez (2021) reveal that teachers consider the allocated course time to be insufficient for the learning-teaching process. Similarly, Ocak and Kocaman (2021) reported that although the number of topics was reduced in the 2018 SSC, teachers still struggled to find sufficient time to implement activities.

In this context, the gradual decrease in the number of learning domains and attainments/learning outcomes may have been intended to reduce content density, deepen learning, and align the instructional process more closely with the principles of the constructivist approach. Indeed, Karadeniz et al. (2015) stated that although the 2005 SSC includes attainments consistent with the constructivist approach, it does not fully reflect the principles of this approach in certain respects. Accordingly, it can be argued that the reductions in the number of learning domains and attainments in subsequent curricula indicate a transformation toward a more simplified, holistic, and practice-oriented curriculum structure.

When the 2005, 2018/2023, and 2024 SSCs developed in Türkiye based on the constructivist approach are compared in terms of skills, it is observed that there were 15 skills in the 2005 SSC and 27 skills in the 2018/2023 SSCs. A notable increase in the number of skills to be acquired by students has occurred with each new curriculum. Similar findings have also been reported in the literature examining skills within SSCs. Eker (2020) indicated that the number of skills in the 2018 SSC increased compared to the 2005 SSC; likewise, Çiftçi and Akça (2019) stated that the number of geographical skills in the 2018 SSC was higher than in the 2005 SSC. Similarly, Önger and Duman (2024) and Gürler and Gürgen (2025) reported that the number of skills increased in the 2024 SSC compared to the 2018 SSC.

One of the findings obtained from the comparison of curricula in terms of skills is the variation in the way skills are presented. In the 2005 SSC, skills were listed, the sub-skills constituting each skill were explained in detail, and "skills to be directly taught" were also defined for each learning domain at all grade levels. In the 2018 SSC, skill categories were listed, and at the beginning of each learning domain for each grade level, the specific skills intended to be developed within that domain were explicitly stated. In contrast, in the 2024 SSC, skills were not presented as a separate list but were integrated within learning domains. This integrated structure has enhanced the systematic nature and coherence of the curriculum.

Similar findings have been reported in the literature. Eker (2020) noted that the presentation of skills differed between the 2005 and 2018 SSCs, stating that instead of specifying "skills to be directly taught" within each unit as in the 2005 SSC, the 2018 SSC presented multiple skills at the beginning of each learning domain. Likewise, Önger and Duman (2024) found that while core skills were addressed under a separate heading in the 2018 and 2023 SSCs, in the 2024 SSC, skills were embedded within learning domains rather than being treated separately.

In order to support students' multidimensional development, the 2024 SSC categorizes skills into four main groups: 11 domain-specific skills, 16 conceptual skills, 9 social-emotional learning skills, and 9 literacy skills. In addition, tendencies aimed at supporting students' attitudes and behaviors throughout the learning process were also incorporated into the curriculum. Yıldırım and Çalışkan (2024), Önger and Duman (2024), Dallı and Hamarat (2025), and Turan et al. (2025) also emphasized in their studies that in the 2024 SSC, which is designed with a skill-based structure, skills are organized under different categories. The structuring of skills under various categories in the 2024 SSC indicates that students' cognitive, social, and affective development is addressed through a holistic approach. However, the increase in the number of skills also brings the risk of superficiality in the instructional process.

The inclusion of tendencies in the curriculum aims to develop not only students' knowledge and skills but also their attitudes and mental dispositions (MoNE, 2025). This aligns directly with the ultimate goal of the social studies course, which is to educate active citizens. Bağçivan et al. (2025) stated that, compared to previous curricula, the CTEM represents an innovative approach in terms of Turkish education policy. When these findings are considered together, it can be argued that the 2024 SSC represents a significant transformation in Türkiye's education system and adopts an innovative approach that prioritizes student-centered and holistic development. This situation can be interpreted as an indication that the curriculum aims not only at improving instructional outcomes but also at achieving a long-term transformation in Türkiye's education policies. Furthermore, in the 2024 SSC, the inclusion of the "Scientific Inquiry" skill—originating from the field of science—within the "Technology and Social Sciences" learning domain at the 7th-grade level demonstrates that interdisciplinary integration has been strengthened. This suggests that the curriculum is not limited to discipline-specific skills but adopts a more holistic understanding of skills that encompasses competencies from different disciplines.

However, despite the adoption of a holistic approach to skills, it is noteworthy that some fundamental skills are not structured explicitly and prominently within the curriculum. The fact that the skill of "perceiving time and chronological thinking" is mentioned only within the "Interrelationships among Skills" section creates the impression that the visibility of this skill—previously included among the domain-specific skills in the 2005 SSC—has decreased within the curriculum. Yet, "perceiving time and chronological thinking" enables students to establish cause-and-effect relationships between events, comprehend historical continuity, and make sense of social change (Demirel & Turan, 2015; Galán, 2016; Seefeldt et al., 2015). In this respect, this skill can be considered a core competency that supports multiple learning domains. Therefore, addressing it merely as a "related skill" may not be sufficient; positioning it more centrally within learning outcomes would likely enhance its functionality. Otherwise, the absence of explicit emphasis on this skill may lead students to develop a more superficial understanding in processes such as establishing chronological relationships, comprehending historical continuity and change, and evaluating the historical background of contemporary events. In this context, the inclusion of certain skills only within the

"Interrelationships among Skills" section may also carry the risk of insufficient emphasis in classroom practices and the possibility of being overlooked over time.

When these findings are considered together, it is understood that SSCs have shown a tendency over time toward simplification, integration, and a skill-based structure. In particular, the 2024 SSC adopts a more holistic and interdisciplinary approach compared to previous curricula; however, it is considered that the positioning of certain core skills within the curriculum could be further reconsidered.

When the 2005, 2018/2023, and 2024 SSCs developed in Türkiye based on the constructivist approach are compared in terms of values, it is observed that while 20 values were included in the 2005 SSC, this number decreased to 18 in the 2018/2023 SSCs, and then increased again to 20 in the 2024 SSC. This finding is also supported by results obtained from various studies in the literature. Çoban and Akşit (2018) reported that there were 20 values in the 2005 SSC and 18 in the 2017 SSC. Similarly, Önger and Duman (2024) indicated that the number of values increased in the 2024 SSC compared to the 2018/2023 SSCs. The number of values reported in the studies by Yıldırım and Çalışkan (2024), Kan and Çevik (2025) and Turan et al. (2025) is also consistent with the findings of this study.

However, it is noteworthy that certain terminological changes have been made in the expression of some values across the SSCs. For example, the value expressed as "being fair" in the 2005 SSC was reformulated as "justice" in the 2018/2023 and 2024 SSCs. Similarly, the value "attaching importance to family unity" was revised as "family integrity" in the 2024 SSC, while "attaching importance to being healthy" was redefined as "healthy living." These changes indicate that values have been reconsidered not only quantitatively but also conceptually and linguistically. In particular, the shift toward more general and inclusive concepts can be interpreted as an effort to facilitate students' more holistic understanding of values and their connection to everyday life. Indeed, the 2024 SSC emphasizes the necessity of integrating values into instructional practices by supporting them with appropriate content, materials, and methods (MoNE, 2024). This suggests that a practice-oriented and experience-based approach, rather than merely conceptual transmission, has been adopted in values education.

Another finding obtained from the comparison of curricula in terms of values is the variation in how values are presented. In the 2005 SSC, values were listed, and comprehensive explanations were provided on issues such as values, approaches to values education, and value analysis; moreover, "values to be directly taught" were specified for each learning domain at all grade levels. In the 2018 SSC, value labels were listed, and at the beginning of each learning domain for each grade level, the specific values intended to be developed within that domain were indicated. In the 2024 SSC, values were addressed within the framework of "virtue–value–action" and were embedded into the learning experiences. Thus, a more practice-oriented and experience-based approach to values education was adopted.

These findings are supported by various studies in the literature. Eker (2020) noted that the presentation of values differed between the 2005 and 2018 SSCs, stating that while the expression "values to be directly taught" included in each unit in the 2005 SSC was removed, in the 2018 SSC values were instead presented at the beginning of learning domains. Yıldırım and Çalışkan (2024) found that methods related to the values education process were explicitly included for the first time in the 2005 SSC, but this approach was abandoned in subsequent curricula. Similarly, Turan et al. (2025) stated that values education was presented comprehensively in the 2005 SSC and was addressed within the "virtue–value–action" framework in the 2024 SSC.

It was found that the values of fairness (justice), family integrity (attaching importance to family unity), diligence, sensitivity, honesty, aesthetics, freedom, responsibility, respect, love, patriotism, and helpfulness are common across all examined SSCs. Another notable finding is that the value of "independence," which was included in the 2005 and 2018/2023 SSCs, is not presented as a direct value in the 2024 SSC but is instead addressed under the heading of "tendencies." This suggests that in the 2024 curriculum, the behavioral dimensions of certain values are brought to the forefront, indicating a shift toward a more dynamic and process-oriented structure in which values are integrated with tendencies.

When the 2005, 2018/2023, and 2024 SSCs developed in Türkiye based on the constructivist approach are compared in terms of Atatürkism-related content, notable differences in scope can be observed. While such content occupies a broader place in the 2005 curriculum, it appears to be considerably reduced in the 2018 and 2023 versions. In this regard, the 2024 curriculum represents an intermediate position, reflecting a partial expansion compared to the 2018/2023 curricula.

The findings obtained from this study are consistent with those reported in the literature. Çoban and Akşit (2018), Çelikkaya et al. (2018), and Güneş and Dündar (2019) for the 2017 SSC, as well as Eker (2020) and Boz (2022) for the 2018 SSC, stated that topics and attainments related to Atatürkism were included to a more limited extent compared to the 2005 SSC. This indicates that topics related to Atatürkism have been addressed within a narrower scope in curricula over time. This change suggests a shift in the content priorities of curricula. However, the narrowing of the scope of Atatürkism should not be interpreted solely as simplification; it should also be discussed in the context of value transmission and the construction of national identity.

In the literature, there is a growing emphasis on the need to address topics related to Atatürkism more comprehensively in curricula. Çelikkaya et al. (2018), in their comparison of the 2005 and 2017 SSCs, argued that the number and quality of attainments related to Atatürkism should be increased. Similarly, studies based on teacher opinions highlight that these topics should be given greater emphasis in curricula. Çelikkaya and Kürümlüoğlu (2018), in their study examining teachers' views on the 2017 SSC, found that teachers believe these topics should occupy a broader place in the curriculum. Likewise, Uygun and Akgül (2024) reported that teachers expressed the opinion that more emphasis should be placed on topics related to Atatürkism in the 2024 SSC.

The reduced emphasis on topics related to Atatürkism in curricula can be criticized in terms of value transmission and the construction of national identity (Çoban & Akşit, 2018; Tay, 2017), while it may also be interpreted as a form of simplification (Boz, 2022). However, the inclusion of "Atatürk's contributions to the founding process of the Republic of Türkiye" among the specific objectives of the 2024 SSC can be considered an improvement compared to previous curricula.

Overall, it is observed that SSCs have evolved over time toward simplification, integration, and a skill-based structure. This transformation indicates that curricula have been restructured not only at the level of content but also in terms of pedagogical approach. While the 2024 SSC presents a more holistic and interdisciplinary perspective compared to previous curricula, it also reveals a need to reconsider the positioning of certain core skills and content elements within the curriculum. In this context, it is considered important that changes in curricula be addressed not only structurally but also in terms of their practical implementation.

The findings of this study reveal that SSCs in Türkiye have undergone not only structural changes over time but have also evolved toward a more holistic, skill-based, and learner-centered framework in line with the constructivist learning approach. In this respect, the study contributes to the existing literature by examining curricular transformations not only at the level of content but also in terms of their theoretical foundations. Furthermore, by analyzing learning areas, learning outcomes, skills, values, and Atatürkism as integrated components, the study offers a comprehensive analytical framework and distinguishes itself from the limited number of comparative studies in the field.

Recommendations

In light of the findings obtained from this study, the following recommendations are proposed:

- Monitoring and evaluation mechanisms may be developed by the MoNE to oversee the implementation processes of school-based planning activities. In this process, it may be recommended to simplify permission procedures to enhance the feasibility of out-of-school activities and, where necessary, to introduce arrangements that support parental involvement.

- Based on the finding that the scope of topics related to Atatürkism has changed over time, it is recommended that these contents be re-evaluated in line with teacher opinions, student needs, and the overall objectives of the curriculum.
- In the 2024 SSC, the inclusion of the skill “perceiving time and chronological thinking” only within the “Interrelationships among Skills” section may limit its visibility within the curriculum. In this regard, it is recommended that this skill be more explicitly defined among learning outcomes, supported through digital applications, and more clearly integrated into assessment and evaluation processes. In this way, it may contribute to the development of students’ awareness of historical continuity and their ability to establish relationships across time.
- In order to determine the effects of quantitative and qualitative changes in learning domains, attainments/learning outcomes, skills, and values on the learning process, it is recommended to increase experimental and qualitative studies focusing on classroom implementations of curricula and to reflect the findings of these studies in curriculum development processes.
- To identify the challenges encountered during the implementation of the 2024 SSC, it is recommended to conduct comprehensive field studies based on teachers’ views and to make evidence-based revisions to relevant components of the curriculum in line with the findings obtained.

Conclusion

This study comparatively examined the SSCs developed in Türkiye (2005, 2018, 2023, and 2024) within the framework of the constructivist approach in terms of formal characteristics, learning domains, learning outcomes, skills, values, and Atatürkism. The findings indicate that SSCs have undergone a significant transformation over time, characterized by a gradual shift toward simplification, integration, and a skill-based structure.

In particular, the reduction in the number of learning domains and learning outcomes reflects an effort to decrease content density and to support deeper learning processes. At the same time, the 2024 curriculum stands out with its more holistic and integrated structure, in which curriculum components are presented in relation to learning domains rather than as separate elements.

Furthermore, the findings reveal that while the scope and presentation of skills and values have evolved across curricula, the 2024 curriculum adopts a more comprehensive and multidimensional approach that supports students’ cognitive, social, and affective development. However, the positioning and visibility of certain core skills and content elements remain an issue that requires further consideration.

Overall, the results suggest that SSCs in Türkiye have evolved not only in terms of content but also in terms of pedagogical orientation, reflecting a transition toward a more learner-centered and practice-oriented structure. In this regard, the 2024 curriculum represents an important step in aligning curriculum design with contemporary educational needs.

CRediT authorship contribution statement

T. Sömen: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing; M. Metin Göksu: Conceptualization, Investigation, Supervision, Writing – original draft; Y. Kop: Data curation, Investigation, Supervision, Writing – original draft

Declaration of Conflicting Interests

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Ethics Approval and Consent to Participate

Since this research used the document analysis method, ethics committee approval was not required.

Declaration of AI Usage Statement

In this study, the AI tool ChatGPT (access date: 05/04/2026; Version: GPT-5.3) was used. The tool was utilized for supportive purposes only, and the scope of use was limited to language editing, grammar checking, academic phrasing, and translation assistance. All content generated or suggested by AI has been reviewed for accuracy and originality by the authors, who take full responsibility. Data obtained through AI tools was reviewed in accordance with ethical and academic principles. AI was used in compliance with COPE and Kastamonu Education Journal publication policies. AI has not been listed as an author or co-author. The scientific content, accuracy, originality, and ethical responsibility of the work belong entirely to the authors.

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|Research Article / Araştırma Makalesi|

Examining the Relationship Between Educators' Political Socialization and Organizational Dissent

Eğitimcilerin Siyasal Sosyalleşmeleri ve Örgütsel Muhalefetleri Arasındaki İlişkinin İncelenmesi

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Keywords

Teachers

School managers

Political socialization

Organizational dissent

Quantitative research

Abstract

This research aims to examine the levels of political socialization and organizational dissent among educators within the context of various demographic variables. Using a relational survey model, data was collected from 596 educators working in a province in southwestern Türkiye of using a simple random sampling method. Data were collected using the Political Socialization Scale for Educators and the Organizational Dissent Scale. MANOVA, ANOVA, Pearson correlation, and Tukey Post Hoc tests were used in the analyses. The findings revealed that educators' political socialization differed significantly according to their branch, union membership, and age; and their organizational dissent differed significantly according to union membership and age. On the other hand, no significant differences were found in terms of workplace, school level, transportation conditions, and education level. While the level of political socialization was generally found to be moderate, a low level of perception was determined in the sub-dimension of views on the political system, and a high level of perception in the sub-dimension of views on education. In organizational dissent, high levels of expressive behaviors were observed, especially in the vertical dissent dimension. In conclusion, significant relationships were found between educators' political socialization and their organizational dissent.

Anahtar Sözcükler

Öğretmenler

Okul yöneticileri

Siyasal sosyalleşme

Örgütsel muhalefet

Nicel araştırma

Öz

Bu araştırma, eğitimcilerin siyasal sosyalleşmeleri ile örgütsel muhalefet düzeylerini çeşitli demografik değişkenler bağlamında incelemeyi amaçlamaktadır. İlişkisel tarama modeliyle yürütülen çalışmada, Türkiye'nin güney batısında yer alan bir ilde görev yapan 596 eğitimciden basit rastgele örnekleme yöntemiyle veri toplanmıştır. Veriler, Eğitimciler için Siyasal Sosyalleşme Ölçeği ve Örgütsel Muhalefet Ölçeği aracılığıyla toplanmış, analizlerde MANOVA, ANOVA, Pearson korelasyon ve Tukey Post Hoc testlerinden yararlanılmıştır. Bulgular, eğitimcilerin siyasal sosyalleşmelerinin branş, sendika üyeliği ve yaş değişkenlerine göre anlamlı farklılık gösterdiğini; örgütsel muhalefetlerinin ise sendika üyeliği ve yaşa göre anlamlı farklılaştığını ortaya koymuştur. Öte yandan görev yeri, okul kademesi, ulaşım koşulları ve eğitim seviyesi değişkenleri açısından anlamlı bir farklılık bulunmamıştır. Siyasal sosyalleşme düzeyi genel olarak orta seviyede tespit edilirken, siyasi düzene bakış alt boyutunda düşük düzeyde algı, eğitime bakışta ise yüksek düzeyde algı belirlenmiştir. Örgütsel muhalefette ise özellikle dikey muhalefet boyutunda yüksek düzeyde ifade davranışları gözlenmiştir. Sonuç olarak eğitimcilerin siyasal sosyalleşmeleri ile örgütsel muhalefetleri arasında anlamlı ilişkiler olduğu belirlenmiştir

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Introduction

Political socialization is a crucial dimension of socialization, referring to the process by which an individual learns, adopts, and develops political knowledge, values, attitudes, and behaviors within society (Akın, 2022). In this process, individuals shape their thoughts and orientations regarding the political system by interacting with their social environment (Kaplan, 2019; Easton, 1968). Simultaneously, individuals learn and internalize the norms and values of the political environment, adapting to the dominant political culture within society (Atkin & Gantz, 1978; Warleight, 2001). In this respect, political socialization plays a significant role in maintaining the continuity and stability of the political system by contributing to the transmission of political values from generation to generation (Köseoğlu, 2020).

The political socialization of individuals begins primarily with the shaping of the political views and attitudes of their families and parents, and then continues to develop under the influence of rules set by the state and especially educational institutions such as schools (Banks & Roker, 1996). In this process, individuals adopt the values and perspective of a particular social or political group and politically integrate with that group (Kaplan, 2019). Although political socialization is a lifelong process, it is more influential during childhood and adolescence, when an individual's fundamental attitudes and values are formed (Greenberg, 2009). While the family is considered the most fundamental and primary source of this process, educational institutions, media, and peer groups also play an important role in the formation of an individual's political attitudes (Nickerson, 2023). However, the social, cultural, and environmental conditions in which the individual lives determine the direction and quality of the political socialization process; therefore, the factors influencing political socialization are examined from various perspectives by different researchers (Diemer, 2012).

The process of political socialization is a multifaceted process that enables individuals to learn political values, attitudes, and behaviors, with various social institutions such as family, peer groups, mass media, and religion playing significant roles. In the literature, the family is considered the primary tool of political socialization because it is the first social environment an individual is in from birth, and individuals develop their earliest political attitudes within this environment (Langton, 1969; Jennings & Niemi, 2015; Nickerson, 2023). In particular, the level of political participation and socioeconomic status of parents can be decisive in shaping children's political interest, knowledge, and participation levels (Verba et al., 2005; Plutzer, 2002). Furthermore, peer groups contribute to political socialization by providing a social space where individuals can discuss, evaluate, and reconsider their existing political attitudes on political issues (Nickerson, 2023; Biswas, 2022). Furthermore, mass media, and especially digital media, have become an important tool for political socialization by facilitating individuals' monitoring of political developments, access to political information, and development of awareness regarding political processes (Van Deth et al., 2011; Nickerson, 2023). However, religion is also considered an important socialization factor that can shape individuals' value systems, influencing their political preferences, attitudes towards political actors, and tendencies towards political participation (Biswas, 2022; Nickerson, 2023).

In the process of political socialization, education and schools stand out as one of the most important institutional mechanisms enabling individuals to participate in the political system. For the continuity of political systems to be ensured, individuals newly joining the system must be made compatible with the existing political structure, values, and norms (Alkan & Ergil, 1980). Political powers attach special importance to education in order to ensure the continuity and stability of political power, and view educational institutions as one of the fundamental tools that facilitate individuals' adaptation to the existing political system (Türkkahraman, 2000). Accordingly, nation-states use schools as an effective tool for political socialization to transmit their political values, norms, and ideological frameworks to society (Candan & Işık, 2019). Through schools, individuals are taught about the functioning of the political system, citizenship rights and responsibilities, and social values; In this process, textbooks and educational materials play an important role in individuals gaining political knowledge and awareness (Türköne, 2005; Baltacı & Uysal, 2012). Especially through subjects like social studies, students acquire knowledge about politics and governance from a young age, develop thinking and evaluation skills on current issues, and gain the cognitive foundation to understand the abstract nature of politics (Nickerson, 2023; Wolfinger & Rosenstone, 1980).

However, the political socialization process is not limited to course content but is also supported through ceremonies, flags, anthems, symbols, and various cultural activities, thereby enabling individuals to develop a sense of belonging to the political system and internalize its values (Alkan, 1979; Şirin, 2008). In this respect, educational institutions have an important function in the integration of individuals into the political system and in ensuring the continuity of the political order. While it is stated that individuals with higher levels of education show greater interest in political events and have a higher tendency towards political participation (Persson, 2015), it is also noted that not every individual included in the education system develops the same level of political awareness (Nickerson, 2023). This situation shows that education plays a central role in political socialization, but that this process is a multidimensional structure shaped by other social factors.

The dominant power, in order to maintain its legitimacy and ensure the continuity of social order, has structured schools as private and controlled spaces, and accordingly defined the roles of students and teachers (Kaplan, 2013). In this process, the dominant ideology influences a wide range of areas, from the goals and objectives of education policies to the content of the curriculum, from the school environment to educational practices, thus becoming decisive in shaping the education system (Gutek, 2019). Indeed, the dominant power ensures the transmission of its own values and understanding through education by keeping many elements under control, from teacher training processes to the preparation of textbooks, from the organization of educational environments to ceremonies and celebrations (Akın & Arslan, 2014). In schools, this ideological transmission mostly takes place through lesson content and teachers, and especially in developing societies, teachers are seen as the primary source of information and authority figures in the classroom (Yapıcı, 2004b). This situation leads to teachers being perceived by students as representatives of the state and the teacher-student relationship acquiring an authority-based structure (Başkaya, 2013). In such a structure, students who conform to and obey authority are defined as "good students," and this contributes to the reproduction of the existing social and political order (Freire, 2013). In addition to the formal curriculum, a hidden curriculum, not explicitly stated but transmitted through school culture and teacher attitudes, also influences the shaping of students' values, attitudes, and behaviors (İnal, 2004).

Dissent, in its broadest sense, is a phenomenon arising from disagreements regarding problems, perceptions, beliefs, and organizational goals within an organization (Zaini et al., 2014), and is a process that can naturally occur in any organization (Kassing, 1997a). Within the organizational structure, dissent generally occurs from bottom to top, in the form of individuals in subordinate positions expressing their differences of opinion towards managers and decision-makers in superior positions within the hierarchical order (Sprague, 2012). The reflection of the phenomenon of dissent, which can be observed in many areas of social life, in an organizational context is conceptualized as organizational dissent (Yıldırım, 2020). Organizational dissent is defined as a form of behavior that arises when organization members express their opposing views and object to the current situation when they do not approve of the policies, practices, and behaviors adopted by managers (Kassing, 1997b).

Organizational dissent is often perceived as a negative and damaging process for the organization and can be considered a threat to managerial authority (Kavak, 2020). However, the literature states that suppressing dissent causes existing problems within the organization to remain invisible, and this situation can negatively affect both organizational functioning and the psychological and professional well-being of employees (Shahinpoor & Matt, 2007). Conversely, it is stated that if organizational dissent is understood correctly and managed effectively, it can function as a feedback mechanism within the organization, contributing to the early detection of problems, the correction of errors, and the support of organizational development and innovation processes (Aksel, 2013; Ergün & Çelik, 2021). In this respect, organizational dissent is considered an important source of information that enables managers to be aware of problems within the organization (Ergün, 2017; İzgüden, 2017). It is also stated that managers with a democratic management approach view organizational dissent as a constructive element that allows them to benefit from the views and suggestions of employees (Eroğlu & Alga, 2018; Özdemir, 2013).

However, it is noted that organizational dissent can sometimes lead to negative consequences. In particular, managers with an authoritarian management style may perceive dissenting behavior as a personal threat and exhibit various negative attitudes towards dissenting employees, such as exclusion, pressure, reassignment, or hindering their professional development (Devine & Maassarani, 2011, as cited in Ergün,

2017; Çam, 2021). Similarly, it is stated that in educational organizations, teachers who exhibit dissenting behavior may face pressure and intimidation from managers (Aydın, 2015). This situation shows that the outcomes of organizational dissent largely depend on the attitudes and management style of the managers. Indeed, research shows that teachers exhibit varying levels of organizational dissent (Gürler, 2020; Özdemir, 2013; Ilıman Püsküllüoğlu & Altunkurt, 2018; Şentürk & Çoşkuner, 2018; Toytok & Uçar, 2018), indicating that organizational dissent is a significant phenomenon in educational organizations. In this context, understanding the constructive and destructive aspects of organizational dissent, and particularly examining teachers' dissent behaviors in schools, is considered crucial for improving organizational functioning.

In this study, educators' political socialization and organizational dissent were examined. Since political socialization and organizational dissent are dynamic processes shaped by many factors, it was considered necessary to include several variables that may be related to these concepts. Accordingly, educators' subject areas, union memberships, ages, place of duty, transportation conditions to school, and education levels were included in the study.

Educators complete a teaching process that includes pedagogical knowledge to acquire the necessary professional skills (Eskicumalı, 2002). During this process, they acquire professional knowledge related to their field in terms of both quality and quantity (Sünbül, 2002). This allows educators to specialize in specific branches. Considering that each teacher training program includes courses specific to their field in addition to general pedagogical knowledge, it is stated that educators' branches can affect many aspects of the educational environment (Paksu, 2008). For example, educators' branches can influence; Based on studies that found significant differences in levels of organizational cynicism (Çillik, 2019; Karaoğlan, 2019; Yalçın, 2021), organizational commitment (Nacar & Demirtaş, 2017), and job satisfaction (Özkan, 2017; Yılmaz & Ceylan, 2011; Yüksel et al, 2023), it is considered important to examine the relationship between educators' subject areas and organizational dissent and political socialization.

Article 51 of the Constitution of the Republic of Türkiye guarantees the establishment and membership of trade unions to protect the rights of both employees and employers (Constitution of the Republic of Türkiye, 1982). An examination of official gazette data from July 5, 2024, reveals that there are a total of 43 education unions, with 1,304,881 employees eligible to join these unions, and 946,149 of these employees already members of a union (Public Sector Unions Statistics, 2024). Therefore, it can be said that education employees have achieved a high rate of unionization. Unions have an ideology that guides all their actions and activities (Mumcuoğlu, 1979). For this reason, employees, when choosing unions to join, prefer unions that develop discourses consistent with their ideological views, in addition to economic and social concerns (Özaydın & Han, 2014). In other words, it can be said that educators who are members of different education unions have different worldviews and political values. Therefore, it is thought that the unions to which educators belong may be closely related to the processes of political socialization and organizational dissent among educators.

On the other hand, as is the case all over the world, in Türkiye experienced educators tend to work in schools with more successful students and in better neighborhoods (Özoğlu et al, 2013), while less experienced young educators work in disadvantaged regions and schools (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2006). Considering this situation, it can be said that older, more experienced educators will experience greater job satisfaction in schools with better resources, while younger educators will have to cope with some problems. Therefore, it is thought that the age variable, which is related to whether educators are experienced or new to the job, will also have an important relationship with educators' political socialization and organizational dissent.

The location where educators work is also an important issue for them. Chapman (2020) notes that educators working in rural areas feel disadvantaged because they lack the same socialization opportunities as those working in urban centers. In other words, educators in rural areas may work in a culturally, socially, psychologically, and professionally isolating environment (Khulel, 2021). Generally speaking, educators in rural areas face problems such as difficult working conditions, insufficient competence in dealing with issues specific to rural schools, lack of access to financial, health, and recreational services, and rewards that are disproportionate to the difficulty of the job (Shikalepo, 2020; Kavak et al., 1997). Therefore, evaluating the

location of the educator's workplace in terms of political socialization and organizational dissent can be important.

Another issue addressed in the research is transportation conditions to school. This is because several studies in the literature highlight the problems educators face in reaching school (Analı & Şahin, 2020; Karataş & Çakan, 2018; Özdemir & Civelek, 2015). Önen and Altındal (2017) state that educators with difficult transportation conditions are negatively affected physically. Ergenekon (2004) notes that difficult transportation conditions cause not only physical fatigue but also a financial burden for educators. Türk and Tulunay Ateş (2021) found that the difficulty of transportation conditions increases communication anxiety among educators. Therefore, it is considered important to examine the relationship between transportation conditions, which can cause physical fatigue, financial difficulties, and negatively impact communication processes, and the processes of political socialization and organizational dissent.

Council of Higher Education ([CoHE], 2018) plans for teacher training programs in Türkiye to last four years. After this period, teachers who wish to do so can complete two years of postgraduate education and four years of doctoral education (Postgraduate Education and Training Regulation, 2016). However, the rate of postgraduate education among teachers in Türkiye is lower than the average of OECD countries (Demirel Yazıcı & Cemaloğlu, 2022). On the other hand, while the rate of teachers pursuing postgraduate education was 11.45% in the 2021 activity report of the Ministry of National Education (Ministry of National Education, Strategy Development Department, 2022), this rate increased to 15.33% in the 2023 activity report (Ministry of National Education, Strategy Development Department, 2024). Based on this, although it lags behind OECD countries, it is evident that there is a growing interest in postgraduate education among educators in Türkiye. Despite the increasing interest in postgraduate education, it has been determined that educators pursuing postgraduate studies face problems such as inability to obtain leave from their institutions, having to travel outside the city for education, conflicts between postgraduate courses and regular school courses (Avcı & Akdeniz, 2021), inability to obtain research permits, and insufficient support (Aktan, 2020). Due to these problems experienced in postgraduate education, it is considered that examining the relationship between educators' educational status and their political socialization and organizational dissent may be important.

In the light of this facts, this research aims to examine the relationships between educators' political socialization and organizational dissent. In this context, the following questions were addressed.

1. When educators' political socialization and organizational dissent are considered separately and together, do they differ significantly according to:

a) their branches,

b) their union membership,

c) their age,

d) the place of the duty,

e) their transportation conditions to school and

g) their educational level?

2. What are the sub-dimensions and item averages of the Political Socialization Scale for educators?

3. What are the sub-dimensions and item averages of the Organizational Dissent Scale for educators?

4. Are there meaningful relationships between political socialization, organizational dissent, and the sub-dimensions of the scales?

Method

Research Design

This study used the relational survey method, which allows the examination of the interrelationships between two or more variables (Karasar, 2009). The aim was to evaluate educators' political socialization and organizational dissent in the context of each other and various variables. The Political Socialization for Educators and Organizational Dissent Scales were used as data collection tools.

Population

In this study, the population was defined as school administrators and teachers working in schools affiliated with the Ministry of National Education in Isparta province during the 2023-2024 academic year. 622 participants were reached using a random sampling method, and data were collected using the Political Socialization Scale and the Organizational Dissent Scales. As a result of the data analysis, outliers were removed from the dataset for both scales. Therefore, the sample of the quantitative phase of the research consists of 596 educators. One of the independent variables of the study, the branch group, revealed that some branches had fewer than 30 participants. This situation could pose a problem for normal distribution. Because, according to Erilli's (2015) Central Limit Theorem, a test can only exhibit a normal distribution if the data is at least 30; values below this indicate that a normal distribution does not occur. Based on this, some branches with fewer than 30 participants, which are considered to be closely related to each other, were grouped together and treated as a single group.

In this study, due to the fact that the number of participants in some branches was below 30 and these branches were closely related in terms of their fields, the relevant branches were combined and included in the analysis process. Accordingly, social studies teaching, history teaching, geography teaching and philosophy teaching were grouped under a single category within the social sciences field. Similarly, music teaching", visual arts teaching, technology and design teaching, and information technology teaching were combined, taking into account the common characteristics of their respective fields. In addition, physics, chemistry, and biology teaching were considered as a single group within the science field. psychological counseling and guidance teaching and special education teaching, which also had fewer than 30 participants, were combined and analyzed due to their similar professional characteristics.

On the other hand, within the scope of the place of duty variable, one of the independent variables, the Imam Hatip Middle School and Imam Hatip High School groups, which had fewer than 30 participants, were combined in order to satisfy the assumptions of the central limit theorem, and the analyses were carried out accordingly.

The frequencies and percentages for the information regarding the branch, union, age, workplace, school level and type, transportation conditions, and education level of the educators who constitute the sample of the quantitative phase of the research are shown in Table 1.

Table 1

Demographic Information of Educators

Demographic Information		f	%
Branch	School Administrators	177	29,7
	Primary School Teachers	124	20,8
	English Teachers	48	8,1
	Special Education-Psychological Counseling and Guidance teachers	43	7,2
	Turkish Language-Turkish Literature Teachers	34	5,7
	Music-Visual Arts-Technology Design-I.T. Teachers	28	4,7
	Maths Teachers	25	4,2
	Social Studies-History -Geography -Philosophy Teachers	22	3,7
	Physical Education Teachers	21	3,5
	Physics, Chemistry, and Biology Teachers	21	3,5
	Kindergarten teachers	20	3,4

Demographic Information		f	%
	Science Teachers	18	3,0
	Religion and Moral Teachers	15	2,5
	Total	596	100
Union Membership	The Educators' Union	184	30,9
	Turkish Education, Teaching and Science Services Branch Public Employees' Union	165	27,7
	The Education Workers' Union	105	17,6
	The Education and Science Workers' Union	92	15,4
	No membership	24	4,0
	Not specified	17	2,9
	Other	9	1,5
	Total	596	100
Age	Between 20 and 30 years	16	2,7
	Between 31 and 40 years	239	40,1
	Between 41 and 50 years	246	41,3
	Over 50 years	95	15,9
	Total	596	100
Place of School	Provincial Center	355	59,6
	District Center	149	25,0
	Village	92	15,4
	Total	596	100
Type of School	Secondary School	239	40,1
	Primary School	196	32,9
	Vocational High School	59	9,9
	High School	48	8,1
	Preschool Institutions	27	4,5
	Imam Hatip Secondary School- Imam Hatip High School	27	4,5
	Total	596	100
Transportation Conditions	Easy	474	79,5
	Hard	122	20,5
	Total	596	100
Education Level	Bachelor's Degree	438	73,5
	Master's Degree	158	26,5
	Total	596	100

As seen in Table 1, 29.7% (n=177) of the participants were school administrators, 20.8% (n=124) were primary school teachers, 8.1% (n=48) were english teachers, 7.2% (n=43) were special education-psychological counseling and guidance, 5.7% (n=34) were turkish language-turkish literature teachers, 4.7% (n=28) were music-visual arts-technology design-information technology teachers and 4.2% (n=25) were mathematics teachers. On the other hand, considering the union affiliations of the participants, it was found that 30.9% (n=184) of the participants were members of The Educators' Union [Eğitim Bir Sen], 27.7% (n=165) of The Education Workers' Union [Eğitim İş], 17.6% (n=105) of Turkish Education, Teaching and Science Services Branch Public Employees' Union [Türk Eğitim Sen], 2.9% (n=17) of The Education and Science Workers' Union [Eğitim Sen], and 1.5% (n=9) of other unions. Furthermore, it was found that 15.4% (n=92) were not members of any union, and 4.0% (n=24) did not wish to specify the union they belonged to.

When the ages of the participants were examined, it was determined that 41.3% (n=246) were in the 41-50 years range, 40.1% (n=239) were in the 31-40 years range, 15.9% (n=95) were in the over 50 years range, and 2.7% (n=16) were in the 20-30 years range. 59.6% (n=355) of the participants worked in the provincial center, 25.0% (n=149) in the district center, and 15.4% (n=92) in the villages. In addition, it was observed that 41.0% (n=239) of the participants worked in secondary school, 32.9% (n=196) in primary school, 9.9% (n=59) in vocational high school, 8.1% (n=48) in high school, 4.5% (n=27) in preschool institutions, and 4.5% (n=27) in Imam Hatip high schools and primary schools. Finally, it was determined that 79.5% (n=474) of the participants had easy transportation to school, 20.5% (n=122) had difficult transportation to school, 73.5% (n=438) had a bachelor's degree and 26.5% (n=158) had a master's degree.

Data Collection Tools

The Political Socialization for Educators and Organizational Dissent scales were used as data collection tools in the study.

Political Socialization Scale for Educators

In this study, the "Political Socialization Scale for Educators" was used to determine the levels of political socialization among teachers and school administrators. Since no scale directly measuring the political socialization levels of educators was found in the literature, this scale was developed for this research. Accordingly, political socialization was considered in the context of adaptation to the existing political order, and an initial pool of 32 questions was created. These items were submitted to the opinions of six experts: one from the field of Turkish language, one from the field of Psychology, and four from the field of Educational Administration. Based on expert opinions, a pilot study was conducted with 15 teachers and 10 school administrators. As a result of the feedback received, some items were removed, and the draft form of the scale was determined as 28 items. The scale is structured using a 5-point Likert scale.

Achieving a sufficient sample size for factor analysis is important in the scale development process. The literature indicates that reaching at least 300 participants is sufficient for factor analysis, and that the sample size should be at least 5 to 10 times the number of items (Kass and Tinsley, 1979; Tabachnick and Fidell, 2013; Field, 2000; Comrey and Lee, 1992). Accordingly, a total of 349 educators, including 298 teachers and 51 school administrators working in Isparta province during the 2023–2024 academic year, were reached, and the resulting sample size was deemed sufficient for factor analysis. During the data preparation process, missing and erroneous data were examined, and data with outliers were removed from the dataset. The suitability of the data for normal distribution was evaluated by examining skewness, kurtosis, and histogram graphs, and it was determined that the dataset exhibited a normal distribution.

Furthermore, Kaiser-Meyer-Olkin (KMO) and Bartlett sphericity tests were conducted to determine the suitability of the dataset for exploratory factor analysis. The KMO value of 0.775 indicates that the sample size is sufficient (Seçer, 2015; Can, 2018). The statistically significant Bartlett test result ($X^2 = 2942.74$; $p<0.001$) shows that there is a sufficient level of relationship between the items for factor analysis. In line with these findings, it was determined that the data set is suitable for factor analysis, and exploratory factor analysis was performed. The results of the factor analysis are shown in Table 2.

In this study, the population was defined as school administrators and teachers working in schools affiliated with the Ministry of National Education in Isparta province during the 2023-2024 academic year. 622 participants were reached using a random sampling method, and data were collected using the Political Socialization Scale and the Organizational Dissent Scales. As a result of the data analysis, outliers were removed from the dataset for both scales. Therefore, the sample of the quantitative phase of the research consists of 596 educators. One of the independent variables of the study, the branch group, revealed that some branches had fewer than 30 participants. This situation could pose a problem for normal distribution. Because, according to Erilli's (2015) Central Limit Theorem, a test can only exhibit a normal distribution if the data is at least 30; values below this indicate that a normal distribution does not occur. Based on this, some branches with fewer than 30 participants, which are considered to be closely related to each other, were grouped together and treated as a single group.

In this study, due to the fact that the number of participants in some branches was below 30 and these branches were closely related in terms of their fields, the relevant branches were combined and included in the analysis process. Accordingly, social studies teaching, history teaching, geography teaching and philosophy teaching were grouped under a single category within the social sciences field. Similarly, music teaching", visual arts teaching, technology and design teaching, and information technology teaching were combined, taking into account the common characteristics

Table 2

Factor Analysis Results

	1.Factor	2.Factor	3.Factor
Item 27	0,781		
Item 20	0,805		0,303
Item 21	0,770		
Item 12	0,721		
Item 18	0,694		
Item 28	0,697		
Item 13	0,700		
Item 10	-0,564		0,414
Item 14	-0,429	0,387	
Item 19	-0,457		0,323
Item 4		0,806	-0,453
Item 3		0,767	-0,399
Item 5		0,763	
Item 7	-0,345		0,597
Item 8	-0,475		0,534
Item 23	-0,401	0,490	0,427

As seen in Table 2, the factor analysis revealed that some items loaded onto more than one factor, preventing a complete identification of the factor structure. In such cases, a method called rotation is used to clarify the distinction between factors and facilitate interpretation (Field, 2013). Interpreting factor extraction methods without rotation is difficult. The choice between orthogonal and oblique rotation methods depends on the relationships between the factors (Tabachnick & Fidell, 2013). In social sciences, orthogonal rotation methods, available in two forms (Varimax and Quartimax), are often preferred due to the negligible differences between the two methods and the ease of interpretation (Büyüköztürk, 2019). Therefore, the Varimax orthogonal rotation method was used in this stage of the scale development study. The rotation, performed to fully identify the items and factors between the factors, showed that all items belonged to a specific factor. The results of the factor analysis after the rotation are presented in Table 3.

Table 3

Rotated Factor Analysis Results

Number of Item	Factor Common Variance	After Rotation		
		1.Factor	2.Factor	3.Factor
Item 20	0,769	0,870		
Item 21	0,718	0,840		
Item 27	0,681	0,781		
Item 18	0,569	0,734		
Item 13	0,594	0,742		
Item 12	0,590	0,732		
Item 28	0,507	0,674		
Item 8	0,555		0,728	
Item 23	0,583		0,732	
Item 10	0,553		0,700	
Item 7	0,484		0,675	
Item 19	0,363		0,566	
Item 14	0,406		0,582	
Item 4	0,856			0,925
Item 3	0,756			0,868
Item 5	0,645			0,788

As shown in Table 3, the revised analysis, eigenvalues, and rotation results revealed a three-factor structure. The first factor, labeled "View on the Political System" (items 20, 21, 27, 18, 13, 12, and 28), explains 31.65% of the total variance; the second factor, labeled "Political Interest" (items 8, 23, 10, 7, 19, and 14), explains 16.14% of the total variance; and the third factor, labeled "View on Education" (items 3, 4, and 5), explains 12.39% of the total variance. The first factor was identified as the most significant, and the three factors of the scale explained 60.18% of the total variance. After determining the factor structure of the scale, the items were renumbered. In this case, the Political System perspective factor consists of items 7, 8, 10, 12, 13, 15, and 16; the Political Interest factor consists of items 4, 5, 6, 9, 11, and 14; and the Education perspective factor consists of items 1, 2, and 3.

The 5-point Likert scale, consisting of 16 items and 3 dimensions, is as follows: Strongly disagree (1), Slightly agree (2), Moderately agree (3), Strongly agree (4), and Strongly agree (5). The scale consists of three dimensions: 1. Views on the political system (items 7, 8, 10, 12, 13, 15, and 16), 2. Political interest (items 4, 5, 6, 9, 11, and 14), and 3. The scale also includes items 1, 2, and 3. There are no reversed items in the scale; a high score indicates high political socialization, while a low score indicates low political socialization.

Cronbach's Alpha, a frequently preferred measurement in social sciences (Field, 2013) for determining the internal consistency reliability of a scale, is used (Bonett & Wright, 2015). This is because Cronbach's Alpha is considered an important measure that must be calculated to demonstrate the validity and reliability of the obtained data (Tavakol & Dennick, 2011). Cronbach's Alpha values for the political socialization scale are given in the Table 4 below.

Table 4

Cronbach's Alpha Values of the political socialization Scale and Its Sub-Dimension

Political Socialization and Sub-Dimensions	Cronbach's Alpha Values	Item Numbers
View of the political order	0,905	7
Political interest	0,779	6
View of education	0,817	3
Political socialization	0,786	16

Table 4 shows that the perspectives on education and perspectives on the political system sub-dimensions of the Political Socialization Scale (ESSÖ-16) developed for educators have a high level of reliability (between 0.80 and 1.00). The "Political Interest" sub-dimension, along with the overall scale, ranges between 0.61 and 0.80, indicating a moderate level of reliability. Based on these results and the obtained reliability coefficients, it can be said that the scale is a reliable measurement tool.

In this study, confirmatory factor analysis was conducted to determine the validity of the political socialization scale. The results of this analysis are given in the table below.

Table 5

Political Socialization Scale CFA Fit Values.

Model	X^2	(X^2/sd)	RMSEA	CFI	GFI	AGFI
	257,556	2,628	0,052	0,963	0,948	0,927

The fit indices in Table 5 were evaluated considering the fit indices specified by Hair et al. (1998). These values are Chi-square/Degrees of Freedom (X2/sd), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), and Root Mean Square Error of Approximation (RMSEA). In addition, the Adjustment Goodness of Fit Index (AGFI) was also considered in the evaluation of the model. According to these values, the DFA also shows that; X2/sd ≤ 3 indicates perfect fit (Meydan & Şeşen, 2015), RMSEA ≤ 0.05 indicates perfect fit, RMSEA ≤ 0.08 indicates acceptable fit (Byrne & Campbell, 1999), GFI ≥ 0.90 indicates perfect fit (Schumacker & Lomax, 2004), and CFI ≥ 0.90 indicates perfect fit (Çokluk et al., 2014). On the other hand, AGFI ≥ 0.85 indicates acceptable fit.

Based on this, it was determined that X2/sd=2.628 ≤ 3 indicates perfect fit, RMSEA=0.052 ≤ 0.08 indicates acceptable fit, CFI=0.963 ≥ 0.90 indicates perfect fit, GFI=0.948 ≥ 0.90 indicates perfect fit, and

AGFI=0.927 ≥ 0.90 indicates perfect fit. Therefore, it can be said that the factors in the obtained model are confirmed by the data, the three-dimensional structure of the scale is validated, and the scale is applicable.

Organizational Dissent Scale

In this study, the Organizational Dissent Scale developed by Kassing (1998) was used to determine the organizational dissent levels of education workers. The original scale can be accessed at http://www.dissentworks.com/organizational-dissent-scale.html. The scale consists of 24 items and three subscales: articulated dissent, antagonistic, and displaced dissent. Items 1, 5, 6, 12, 13, 14, 16, 19, and 22 measure articulated dissent; items 2, 4, 7, 9, 11, 15, 18, 21, and 23 measure antagonistic dissent; and items 3, 8, 10, 17, 20, and 24 measure displaced dissent.

The scale has a five-point Likert-type structure. Participants respond to each item on a scale ranging from "strongly disagree (1)" to "strongly agree (5)." The adaptation of the scale to Turkish was conducted by Ergün and Çelik (2018), and some items were removed. Following the adaptation, the item numbers were rearranged, reducing the scale to 17 items. Accordingly, items 3, 4, 10, 11, 13, and 15 measure articulated dissent; items 1, 5, 7, 9, 14, and 16 measure antagonistic dissent; and items 2, 6, 8, 12, and 17 measure displaced dissent. Items 2, 3, 4, 6, 8, and 10 are inverse items. The analyses were performed taking this into consideration.

The three subscales in the scale are not contradictory and can be assessed separately. Therefore, separate scores can be scored for each dimension, and a total scale score can be calculated. High scores indicate a high level of organizational dissent; low scores indicate a low level of organizational dissent.

The Cronbach's Alpha values, which indicate the degree of internal consistency of the Organizational Dissent Scale, are given in the Table 6 below.

Table 6

Cronbach's Alpha Values of Organizational Dissent Scale and Its Sub-Dimension

Organizational Dissent and Sub-Dimensions	Cronbach's Alpha Values	Item Numbers
Articulated Dissent	0,96	6
Antagonistic Dissent	0,96	6
Displaced Dissent	0,97	5

An examination of Table 6 reveals that the reliability coefficients for the "Articulated Dissent", "Antagonistic Dissent" and "Displaced Dissent" sub-dimensions, as well as the overall scale, range from 0.80 to 1.00, indicating a high level of reliability. Therefore, based on the data obtained, the scale can be considered a reliable measurement tool.

In this study, confirmatory factor analysis was conducted to determine the validity of the Organizational Dissent Scale. The results of this analysis are given in the Table 7 below.

Table 7

Organizational Dissent Scale CFA Fit Values

Model	X^2	(X^2/sd)	RMSEA	CFI	GFI	AGFI
	486,935	4,387	0,075	0,824	0,910	0,876

Based on this, it was determined that X2/sd=4.387 ≤ 5 indicates an acceptable fit, RMSEA=0.075 ≤ 0.08 indicates an acceptable fit, CFI=0.824 ≥ 0.90 indicates an acceptable fit, GFI=0.910 ≥ 0.90 indicates an excellent fit, and AGFI=0.876 ≥ 0.90 indicates an acceptable fit. Therefore, it can be said that the factors in the obtained model are confirmed by the data, the three-dimensional structure of the scale is validated, and the scale is applicable.

Data Collection Process

The data collection process was initiated on September 11, 2023, the beginning of the 2023-2024 academic year. In order to ensure that the process did not disrupt educational activities, the necessary

information was first provided to the relevant school administrators; then, appropriate time periods for teachers to participate were meticulously determined. The research sample consisted of 596 teachers selected through simple random sampling method among teachers working in city center of Isparta and its districts. In order to examine the relationship between the political socialization levels of the sample group and their organizational dissent tendencies, the "Political Socialization Scale for Educators" developed by Türk (2024) and the "Organizational Dissent Scale" developed by Kassing (1998) and adapted to Turkish by Ergün and Çelik (2018) were used. Permissions for the use of the Organizational Dissent Scale have been obtained from the authors who adapted the scale into Turkish.

Data Analysis

Data on the demographic characteristics of the participants were analyzed using descriptive statistics by calculating frequency and percentage distributions. Some items in the Organizational Dissent Scale were reverse-structured, and these items were appropriately reversed before being included in the dataset. There were no reversed items in the Political Socialization Scale. The relationships between political socialization and the sub-dimensions of organizational dissent were evaluated using the Pearson Correlation Coefficient. In addition, multivariate analysis of variance (MANOVA) was used in the study. It could be considered to test the relationships of the dependent variables, Political Socialization and Organizational Dissent, with the independent variables separately using ANOVA. However, analyzing the collected data with ANOVA on each dependent variable causes an increase in the error expressed as Type 1 error (Seçer, 2015). Furthermore, when this analysis is performed in this way, relationships between dependent variables, which are thought to have a very important relationship, are not revealed and are neglected (Field, 2013).

Therefore, in the present research, multivariate analysis of variance (MANOVA) test was used, which allows the examination of whether two dependent variables have significant differences together and separately on the independent variables (Field, 2007). Because with MANOVA, the need to perform separate analyses for each dependent variable is avoided, and the repeated inclusion of Type 1 error, which arises from separate analyses, is prevented (Seçer, 2015). As a result of this analysis, ANOVA analysis was performed to determine which dependent variable the independent variables with significant differences had a significant difference on. Finally, the Tukey Post-Hoc test was considered to determine between which groups of independent variables the significant difference existed.

However, it is stated that certain conditions must be met in order to obtain accurate results from one-way MANOVA analysis, and although these conditions are similar to the assumptions of ANOVA, they are extended for multivariate cases (Field, 2013). These assumptions are given below:

1. Each data set must be different from the others.
2. Data must be randomly sampled from the population and measured at an interval level.
3. Normal distribution must be ensured.
4. Multivariate normality must be ensured.
5. There should be no difference between the covariance matrices.

It can be said that the first two assumptions mentioned above are met because the data sets are different from each other and the data are measured randomly from the sample with equal interval scales. The examination of whether univariate normality, which is another assumption, is met was evaluated by examining the skewness and kurtosis values and histogram graphs. Tabachnick and Fidell (2007) state that for a normal distribution, the skewness and kurtosis values should be between -1.5 and +1.5. Furthermore, Taşpınar (2017) states that a normal distribution is achieved when the skewness and kurtosis values, divided by their respective standard errors, are between -1.96 and +1.96.

Accordingly, as a result of the analyses conducted to test the univariate normal distribution, it was determined that almost all of the Political Socialization and Organizational Dissent scales had skewness and kurtosis values between -1.5 and +1.5, and their histogram graphs were symmetrical and bell-shaped. Based on this, it can be said that the data set meets the assumption of univariate normality.

Another assumption for conducting the MANOVA test is that the data set exhibits a multivariate normal distribution. Can (2018) states that multivariate normality can be checked by calculating the Mahalonobis Distance using the SPSS analysis program. To determine whether this assumption is met, the Mahalonobis distance was calculated for the data set. Based on this, Mahlonobis Distance was evaluated in Table 8 according to the number of independent variables (8) and significance level.

Table 8

Critical Value and Significance Values

	Significance Level				
Std.dev.	0,10	0,05	0,02	0,01	0,001
8	13,362	15,507	18,168	20,090	26,125

As shown in Table 8, the critical value for the 8-independent variable dataset is expressed as 26.125 according to the significance level of .001. In the current dataset, the highest Mahlonobis Distance value was found to be 14.169. In light of this data, it can be said that there is no value that disrupts the normality of multivariate distribution, as the critical value (26.125) is considerably higher than the Mahlonobis Distance (14.169) for this dataset. Therefore, it has been determined that the current dataset provides a multivariate normal distribution. Another assumption is that there should be no significant difference between the covariances of the dependent variables. This assumption is examined with the Box's Test of Equality of Covariance Matrices (Can, 2018). In this test, if the p-value is greater than .05, it is stated that the assumption of equality of covariance matrices is met (Hair et al., 1995). The Box Test results, which are part of the MANOVA test, are given in Table 9.

Table 9

Box Testi Sonuçları

Political Socialization	**Box Testi**	
Organizational Dissent	**Box's M**	**p**
Branch	44,210	0,200
Union	45,540	*0,001*
Age	12,990	0,176
Place of work	11,468	0,770
School level and type	8.946	0,888
Transportation conditions	2,713	0,441
Education levels	1,594	0,663

When examining Table 9, which shows the Box Test results, it is observed that the p-values of the independent variables other than "Union" are greater than 0.05. In other words, it can be said that the assumption of equality of covariance matrices is not met for the independent variable "Union". However, Field (2013, pp. 1858-1859) and Can (2018, p. 207) state that if this assumption is not met, the sample sizes should be checked, and that if the numbers of both dependent variable groups are equal, MANOVA will not be affected by the non-fulfillment of this condition. Based on this, it can be said that the assumption of equality of covariance matrices is met for the dependent variables Political Socialization and Organizational Dissent because the sample sizes are equal (n=596). In conclusion, according to this information, it has been determined that all the assumptions necessary for obtaining accurate and reliable results from the MANOVA analysis are met.

Validity, Reliability, and Ethics

All stages of the research were conducted in accordance with the ethical principles that must be adhered to in scientific research. Therefore, the necessary legal and ethical permissions were obtained before commencing the study. Initially, approval was obtained from the Burdur Mehmet Akif Ersoy University Ethics Committee (GO 2023/412) dated July 5, 2023, and research permits were obtained from the Isparta Provincial Directorate of National Education (E-27749142-605.01-80879295) dated August 3, 2023.

All participants were informed about the purpose and process of the study and provided written informed consent. Participants were provided with contact information for the researchers and were clearly informed that they had the right to withdraw from the study at any time. All these ethical practices enabled participants to trust the process and express their opinions sincerely.

Findings

Examining the Political Socialization and Organizational Dissent of Educators According to Various Variables.

The MANOVA method was used to determine whether the educators' branches, unions, ages, places of duty, school level, transportation conditions to school and education levels have a significant difference on political socialization and organizational dissent.

Findings Regarding Political Socialization and Organizational Dissent According to Branch

The results of the ANOVA test regarding the political socialization and organizational dissent of educators according to their branches are given in Table 10.

Table 10

MANOVA Test Results According to Educators' Branches

	Branch	n	$\overline{X}$	Std.dev.	λ	P
Political Socialization	School Administrator	177	47,57	8,14	0,888	0.000
	English Teachers	48	41,88	7,31		
	Science Teachers	18	40,83	7,01		
	Mathematics Teachers	25	43,60	8,26		
	Turkish and Turkish Literature Teachers	34	42,50	10,36		
	Social Studies-History-Geography-Philosophy Teachers	22	44,00	10,11		
	Primary School Teachers	124	44,05	8,46		
	Religious Techers	15	46,13	8,36		
	Physical Education Teachers	21	42,33	10,35		
	I.T.-Music-Technology Design and Visual Arts Teachers	28	43,46	8,83		
	Preschool Teachers	20	41,70	10,81		
	Special Education-Psychological Counseling and Guidance Teachers	43	40,77	6,06		
	Physics, Chemistry, Biology -Vocational Subject Teachers	21	40,95	7,79		
Organizational Dissent	School Administrator	177	59,74	7,76		
	English Teachers	48	58,65	6,82		
	Science Teachers	18	63,28	7,96		
	Mathematics Teachers	25	59,80	7,01		
	Turkish and Turkish Literature Teachers	34	57,09	8,05		
	Social Studies-History-Geography-Philosophy Teachers	22	57,32	7,73		
	Primary School Teachers	124	57,66	6,88		
	Religious Techers	15	55,53	4,36		
	Physical Education Teachers	21	58,53	8,02		
	I.T.-Music-Technology Design and Visual Arts Teachers	28	58,36	6,85		
	Preschool Teachers	20	59,15	8,03		
	Special Education-Psychological Counseling and Guidance Teachers	43	59,37	6,94		
	Physics, Chemistry, Biology -Vocational Subject Teachers	21	57,09	7,29		

According to the results of the MANOVA analysis conducted to determine whether educators' political socialization and organizational dissent levels differed based on their branch are presented in Table 10. The analysis revealed that educators' branch had a significant effect on at least one dependent variable (Wilks'

Lambda = 0.888; p < 0.001). This finding indicates that the branch variable creates a significant difference in the levels of political socialization and/or organizational dissent.

Following this general result from the MANOVA test, a one-way analysis of variance (ANOVA) was applied to determine the dependent variable that caused the difference. The results are given in Table 11.

Table 11

MANOVA Test Results According to Educators' Branches

Independent Variable	Dependent Variables	Sum of Squares	df	Mean Square	F	P
Branch	Political Socialization	3581,225	12	298,435	4,209	0
	Organizational Dissent	1094,39	12	91,199	1,695	0,064

According to the ANOVA analysis in Table 11, educators' branch did not create a statistically significant difference in their organizational dissent levels (p = 0.064 > 0.05). However, a significant difference in political socialization levels was determined based on branch (p < 0.001). The results of the Tukey HSD (Post Hoc) test were analyzed to determine which branches accounted for this significant difference in the political socialization variable. Based on the findings, a significant difference was determined between school administrators and English teachers, classroom teachers, special education and guidance teachers, and physics, chemistry, biology, and vocational course teachers.

When the mean scores across groups were examined, the mean level of political socialization for school administrators ($\overline{X}$ = 47.80) was significantly higher than the mean scores for English teachers ($\overline{X}$ = 41.08), classroom teachers ($\overline{X}$ = 44.05), special education and guidance counseling teachers ($\overline{X}$ = 40.77), and physics-chemistry-biology-vocational course teachers ($\overline{X}$ = 40.95). These findings suggest that school administrators have higher levels of political socialization than the teacher groups mentioned.

Findings Regarding Political Socialization and Organizational Dissent According to Union

The results of the MANOVA test regarding the political socialization and organizational dissent of educators according to the unions they belong to are given in Table 12. In Türkiye, there are four unions with the largest number of educator members. These are, respectively, The Educators' Union (Eğitimciler Birliği Sendikası[Eğitim-Bir-Sen]) , The Education Workers' Union (Eğitim işgörenleri Sendikası [Eğitim-İş-Sendikası]), The Education and Science Workers' Union (Eğitim ve Bilim Emekçileri Sendikası [Eğitim-Sen]) and the Turkish Education, Teaching and Science Services Branch Public Employees' Union (Türk Eğitim, Öğretim ve Bilim Hizmetleri Kolu Kamu Çalışanları Sendikası[Türk-Eğitim-Sen]).

Table 12

MANOVA Test Results According to Educators' Union Membership

	Union	N	X	Std.dev.	λ	P
Political Socialization	The Educators' Union	184	47,54	8,48	0,841	0.000
	Turkish Education, Teaching and Science Services Branch Public Employees' Union	105	46,51	9,39		
	The Education Workers' Union	165	40,42	6,74		
	The Education and Science Workers' Union	17	43,53	5,40		
	No membership	92	41,78	8,08		
	Not specified	24	47,25	9,38		
	Other	9	39,56	9,84		
Organizational Dissent	The Educators' Union	184	57,51	7,53		
	Turkish Education, Teaching and Science Services Branch Public Employees' Union	105	58,53	6,57		
	The Education Workers' Union	165	60,77	7,53		
	The Education and Science Workers' Union	17	57,18	6,38		
	No membership	92	58,21	7,56		
	Not specified	24	58,13	5,46		
	Other	9	58,67	9,50		

According to the results of the MANOVA testin Table 12, conducted to determine whether educators' levels of political socialization and organizational dissent differed based on their union membership, are presented below. According to the findings, it was determined that the union variable caused a statistically significant difference on at least one of the dependent variables (Wilks' Lambda = 0.841; p < 0.001). Therefore, a one-way analysis of variance (ANOVA) was conducted to determine which dependent variable caused the significant difference. The results are given in Table 13.

Table 13

ANOVA Test Results According to Educators' Unions

Independent Variable	Dependent Variables	Sum of Squares	df	Mean Square	F	P
Union	Political Socialization	5940,107	6	990,018	14,959	0
	Organizational Dissent	1043,128	6	173,855	3,259	0,004

The ANOVA results indicate that educators' union memberships created significant differences in both political socialization (p < 0.001) and organizational dissent (p = 0.004) levels. The results of the Tukey HSD (Post Hoc) test, conducted to determine the groups between which these differences occurred, were examined in detail.

Significant differences in terms of the political socialization variable were found between The Educators' Union and The Education Workers' Union, and between the group without union membership; This difference was found to occur between Turkish Education, Teaching and Science Services Branch Public Employees' Union and The Education Workers' Union, and between the non-union group, as well as between the group that did not report union membership and The Education Workers' Union. When the mean scores of the groups were evaluated, it was observed that the mean political socialization score of teachers who were members of The Educators' Union ($\overline{X}$ = 47.54) was significantly higher than the means of The Education Workers' Union members ($\overline{X}$ = 40.42) and non-union participants ($\overline{X}$ = 41.78). Similarly, the mean score of Turkish Education, Teaching and Science Services Branch Public Employees' Union members ($\overline{X}$ = 46.51) was found to be higher than that of The Education Workers' Union ($\overline{X}$ = 40.42) and the non-union group ($\overline{X}$ = 41.78). Furthermore, the mean score of participants who did not report union membership ($\overline{X}$ = 47.25) was higher than the mean score of The Education Workers' Union members ($\overline{X}$ = 40.42).

Regarding the organizational dissent variable, the significant difference was found only between The Educators' Union and The Education Workers' Union members. In this context, the average organizational dissent score of the participants who are members of the The Education Workers' Union ($\overline{X}$ = 60.78) is significantly higher than the average of the The Educators' Union members ($\overline{X}$ = 57.51).

Findings Regarding Political Socialization and Organizational Dissent According to Age

The MANOVA results regarding educators' political socialization and organizational dissent according to their age are given in Table 14.

Table 14

MANOVA Test Results According to Educators' Ages

	Age	n	$\overline{X}$	Std.dev.	λ	P
Political Socialization	Between 20 and 30 years old	16	40,19	5,50	0,946	0.000
	Between 31 and 40 years old	239	42,50	8,06		
	Between 41 and 50 years old	246	45,54	9,23		
	Over 50 years old	95	46,03	8,26		
Organizational Dissent	Between 20 and 30 years old	16	60,86	7,94		
	Between 31 and 40 years old	239	59,77	7,12		
	Between 41 and 50 years old	246	58,01	7,51		
	Over 50 years old	95	57,63	7,34		

According to the results of the MANOVA test conducted to examine whether there were significant differences in the levels of political socialization and organizational dissent of educators based on their age groups are presented below. The analysis determined that the age variable caused a significant difference in at least one dependent variable (Wilks' Lambda = 0.946; p < 0.001). A one-way analysis of variance (ANOVA)

was applied to determine the variable(s) that caused this overall difference. And the results are given in Table 15.

Table 15

ANOVA Results Based on Educators' Ages

Independent Variable	Dependent Variables	Sum of Squares	df	Mean Square	F	P
Age	Political Socialization	1706.481	3	568,827	7,792	0,000
	Organizational Dissent	575.496	3	191,832	3,561	0,014

According to the ANOVA results, the educators' ages created significant differences in both political socialization ($p < 0.001$) and organizational dissent ($p = 0.014$) levels. The findings of the Tukey HSD (Post Hoc) test, conducted to determine which age groups these differences occurred between, are summarized below. Multiple comparisons of the political socialization variable revealed that the "31-40" age group had significantly lower scores than the "41-50" and "over 50" age groups. When the mean values were examined, the mean for the 50 and over group ($\overline{X} = 46.03$) and the mean for the 41-50 age group ($\overline{X} = 45.54$) were significantly higher than the mean for the 31-40 age group ($\overline{X} = 42.49$). This suggests a tendency for increasing levels of political socialization with age.

Regarding the organizational dissent variable, the significant difference was found between the "31-40" age group and the "41-50" age group. Considering the group means, the mean for the 41-50 age group ($\overline{X} = 45.54$) was higher than the mean for the 31-40 age group ($\overline{X} = 42.49$). This finding suggests that middle-aged educators have higher levels of organizational dissent than younger educators. Consequently, it can be said that educators exhibit significant differences in both political socialization and organizational dissent based on their age, with these levels being particularly high in those aged 41 and older.

Findings Regarding Political Socialization and Organizational Dissent According to Place of Duty

According to the MANOVA results on educators' Political Socialization and Organizational Dissent by Place of Duty are presented below. When the results are examined, it was found that educators working in different locations did not differ on either the dependent variables of Political Socialization and Organizational Dissent ($\lambda=0.995$, $p=0.582>0.05$).

Findings regarding political socialization and organizational dissent according to place of school grade and type. The MANOVA results regarding the political socialization and organizational dissent of educators according to their workplaces are given in Table 16.

Table 16

MANOVA Test Results According to Educators' Place of School

	Place of School	N	$\overline{X}$	Std.dev.	λ	P
Political Socialization	Provincial center	355	44,36	8,45	0,995	0.582
	District center	149	44,07	9,57		
	Village	92	44,12	8,17		
Organizational Dissent	Provincial center	355	58,55	7,43		
	District center	149	58,46	6,75		
	Village	92	59,90	8,14		

According to the MANOVA results on educators' political socialization and organizational dissent by level of education, it is observed that different school grades and types did not create a significant difference in political socialization and organizational dissent ($\lambda=0.970$, $p=0.059>0.05$).

Findings Regarding Political Socialization and Organizational Dissent According to Transportation Conditions

The MANOVA results regarding educators' political socialization and organizational dissent according to their educational level are given in Table 17.

Table 17

MANOVA Test Results of Educators According to School Level and Type

	School Type and Level	n	$\overline{X}$	Std.dev.	λ	P
Political Socialization	Primary School	196	44,03	8,01	0,970	0.059
	Middle School	239	44,74	9,08		
	High School	48	43,92	9,39		
	Preschool	27	43,15	7,98		
	Vocational High School	59	44,58	9,21		
	Imam Hatip Secondary- High School	27	42,56	8,43		
Organizational Dissent	Primary School	196	59,31	7,44		
	Middle School	239	58,53	7,22		
	High School	48	57,63	7,47		
	Preschool	27	63,04	7,02		
	Vocational High School	59	56,97	7,19		
	Imam Hatip Secondary- High School	27	57,93	7,62		

According to the MANOVA results, there is no significant difference between educators working at different school levels and types in terms of the combined dependent variable (political socialization and organizational dissent) (λ=0.970, p=0.059).

Findings Regarding Political Socialization and Organizational Dissent According to Transportation Conditions

The MANOVA results regarding educators' political socialization and organizational dissent based on their school transportation conditions are given in Table 18.

Table 18

MANOVA Test Results Based on Educators' Transportation Conditions

	Transportation	N	$\overline{X}$	Std.dev.	λ	P
Political Socialization	Hard	474	44,58	8,80	0,997	0.137
	Easy	122	42,99	8,15		
Organizational Dissent	Hard	474	58,59	7,25		
	Easy	122	59,30	7,91		

According to the MANOVA results, there is no significant difference in the combined dependent variable (political socialization and organizational dissent) among educators with different transportation conditions (λ=0.997, p=0.137).

Findings Regarding Political Socialization and Organizational Dissent According to Education Levels

The MANOVA results regarding educators' political socialization and organizational dissent according to their education levels are given in Table 19.

Table 19

MANOVA Test Results of Educators' Educational Levels

	Education Level	n	$\overline{X}$	Std.dev.	λ	P
Political Socialization	Bachelor's Degree	438	43,57	9,06	0,997	0.409
	Master's Degree	158	44,25	8,69		
Organizational Dissent	Bachelor's Degree	438	58,85	7,27		
	Master's Degree	158	58,42	7,71		

According to the MANOVA results regarding educators' political socialization and organizational dissent based on education levels, there was no significant difference in the political socialization and organizational dissent of educators with different education levels (λ=0.997, p=0.409>0.05).

Findings Regarding the Relationships between the Political Socialization and Organizational Dissent Scales

This section of the study presents the item means for the scales used to collect data in the study, as well as the findings regarding the relationships between political socialization and organizational dissent and their sub-dimensions.

Findings Regarding the Items and Sub-Dimensions of the Political Socialization Scale for Educators

The mean scores of educators on the items and sub-dimensions of the political socialization scale are given in Table 20.

Table 20

Mean Scores for the Items and Sub-dimensions of the Political Socialization Scale.

Factors	Items	$\overline{X}$	Std.dev.	Result
View of Political Order (1. factor)	7. I support the current political system of the country.	2,40	1,23	
	8. I believe that the current political system of the country is compatible with the social values I hold.	2,46	1,22	
	10. I believe that political developments in our country are reported impartially in the mass media.	1,73	1,00	
	12. I believe that all institutions in Türkiye operate according to legal norms, especially the constitution.	2,26	1,11	
	13. I believe that social rights are fully provided by the state in our country.	2,44	1,05	
	15. I believe that all political views are given equal space in the media in our country.	1,77	0,98	
	16. I believe that there is a political environment in our country that allows for the free expression of political views in public places.	2,06	1,15	
	Political System View (Total)	**2,17**	**1,10**	**Low**
Political Interest (2. factor)	4. I believe that I can influence politics by being a member of a political party.	2,23	1,32	
	5. I participate in political life through civil society organizations.	2,38	1,27	
	6. I follow political events and political speeches.	3,35	1,15	
	9. I believe that I have sufficient knowledge about political institutions.	3,40	1,09	
	11. I follow political developments through media outlets (television, newspapers, social media, etc.).	3,74	1,08	
	14. I believe I have sufficient knowledge about how politics works.	3,74	1,08	
	4. I believe that I can influence politics by being a member of a political party.	3,32	1,02	
	Political Interest (Total)	**3,01**	**1,15**	**Middle**
View of Education (3.factor)	1. I believe I have been raised as a socially well-adjusted individual thanks to educational institutions.	3,69	0,95	
	2. I believe I have been raised as a good citizen for my country thanks to educational institutions.	3,80	1,00	
	3. I believe I have adopted the national political culture thanks to the education system.	3,21	1,16	
	Views on Education (Total)	3,57	1,03	Middle
	Total Scale	**2,76**	**1,11**	**Middle**

When the mean scores for the sub-dimensions are examined based on the educators' responses to the political socialization scale, it is seen that the mean score for the View of Political Order sub-dimension ($\overline{X}$ = 2.17) is the lowest. The mean score for the Political Interest dimension ($\overline{X}$ = 3.01) indicates a moderate level of interest, while the mean for the View of Education dimension ($\overline{X}$ = 3.57) is higher than the other sub-dimensions. In addition, the total mean score on the general political socialization scale was calculated as ($\overline{X}$ = 2.76), and based on this finding, it can be said that the participants' levels of political socialization were at a moderate level. The item with the highest mean among all scale items was " I believe I have adopted the national political culture thanks to the education system," located in the Views on Education dimension, with a mean of ($\overline{X}$ = 3.80). Conversely, the item with the lowest mean was " I believe that political developments in our country are reported impartially in the mass media.," located in the Views on Political Order dimension, with a mean of ($\overline{X}$ = 1.73).

Findings Regarding the Items and Sub-dimensions of the Organizational Dissent Scale

The mean scores for the items and sub-dimensions of Organizational Dissent performance are given in Table 21.

Table 21

Mean Scores for Items and Sub-dimensions of the Organizational Dissent Scale.

Factors	Items	$\overline{X}$	Std.dev.	Result
Articulated Dissent (1. Factor)	3*. I do not question my school administrators.	3,80	1,12	
	4*. I am hesitant to question school policies.	3,84	1,03	
	10*. I do not say anything to my administrator about decisions I disagree with.	3,93	1,04	
	11. I talk to my administrators when I question decisions at my school.	3,81	1,04	
	13. I make suggestions to my administrators to address shortcomings at my school.	3,95	1,00	
	15. I tell my administrators when I think that employees at my school are being treated unfairly.	3,92	1,04	
	Articulated Dissent (Total)	3,87	1,05	High
Antagonistic dissent (2. Factor)	1. I complain about what's happening at my school together with other teachers.	2,75	1,11	
	5. I act together with other teachers in complaining about changes at school.	2,99	1,13	
	7. I openly share my criticisms of my school.	3,68	1,00	
	9. Everyone knows when I'm not happy with school policies.	3,36	1,19	
	14. I never talk to my fellow teachers about problems at school.	4,29	0,95	
	16. I comfortably talk to other teachers about issues that cause problems at school.	3,98	0,93	
	Antagonistic dissent (Total)	3,51	1,05	Middle
Displaced Dissent (3. Factor)	2*. I don't share work-related issues at home.	3,17	1,21	
	6*. I don't complain about work in front of my family.	2,99	1,23	
	8*. I rarely talk about my school-related problems with my spouse or friends outside of school.	2,93	1,22	
	12. I talk to people outside of school about work-related issues.	2,44	1,15	
	17. I talk to my family or friends about school-related decisions that I can't comfortably discuss at school.	2,89	1,23	
	Displaced Dissent (Total)	2,89	1,21	Low
	Total Scale	**3,67**	**1,16**	**High**

*= *reverse items*

When the items and sub-dimensions of the Organizational Dissent Scale were examined, it was seen that the mean score for the Articulated dissent sub-dimensions was ($\overline{X}$ = 3.87), the mean score for the Antagonistic dissent was ($\overline{X}$ = 3.51), and the mean score for the displaced dissent was ($\overline{X}$ = 2.89). The overall mean score for the scale was ($\overline{X}$ = 3.67).

Among all the items, the highest mean was for the statement "I never talk to my fellow teachers about problems at school," a reverse item in the Antagonistic dissent dimension, with a notable mean score of ($\overline{X}$ = 4.30). Conversely, the item with the lowest mean was for the statement "I talk to people outside of school about work-related issues," a statement in the displaced dissent dimension, with a mean score of ($\overline{X}$ = 2.44).

Relationships between Political Socialization and Organizational Dissent

The relationships between educators' political socialization, organizational dissent, and the sub-dimensions of these concepts were analyzed by using the Pearson correlation coefficient.

Table 22

Relationships Between Political Socialization, Organizational Dissent, and Sub-Dimensions

		Organizational Dissent	Articulated Dissent	Antagonistic Dissent	Displaced Dissent
Political Socialization	r	-0,042	0,052	0,047	-,164**
	p	0,311	0,206	0,252	0
	N	596	596	596	596
View of Political Order	r	-,236**	-,142**	-,183**	-,138**
	p	0	0	0	0,001
	N	596	596	596	596

		Organizational Dissent	Articulated Dissent	Antagonistic Dissent	Displaced Dissent
Political Interest	r	,254**	,271**	,317**	-0,065
	p	0	0	0	0,114
	N	596	596	596	596
View of Education	r	-0,044	0,012	0,008	-,099*
	p	0,28	0,769	0,843	0,016
	N	596	596	596	596

**= Significant relationship

According to the analysis results, no significant relationship was found between political socialization and organizational dissent (r = -0.042, p = 0.311 > 0.05). Similarly, no significant relationship was found between political socialization and articulated dissent (r = 0.052, p = 0.206 > 0.05) or antagonistic dissent (r = 0.047, p = 0.252 > 0.05). However, a significant and negative relationship was found between political socialization and displaced dissent(r = -0.164, p = 0.00 < 0.05). The magnitude of this relationship is small according to the classification of Büyüköztürk et al. (2016). When evaluated in terms of organizational dissent, a small, significant, and negative relationship was found between organizational dissent and the view of the political order sub-dimension (r = -0.236, p = 0.00 < 0.05). On the other hand, a small, significant, and positive relationship was found between organizational dissent and political interest (r = 0.254, p = 0.00 < 0.05). No significant relationship was found between organizational dissent and the other sub-dimension of political socialization, view of education (r = -0.044, p = 0.00 < 0.05, although a p value was stated, the relationship was not found to be significant).

When examined on the basis of sub-dimensions; Small, significant negative relationships were found between views on the political order and articulated dissent (r = -0.142, p = 0.00 < 0.05), antagonistic dissent (r = -0.183, p = 0.00 < 0.05), and displaced dissent(r = -0.138, p = 0.00 < 0.05).

The political interest sub-dimension showed a small, significant, and positive relationship with articulated dissent (r = 0.271, p = 0.00 < 0.05). A moderate, significant, and positive relationship was found with antagonistic dissent (r = 0.317, p = 0.00 < 0.05). However, no significant relationship was found between political interest and displaced dissent(r = -0.065, p = 0.114 > 0.05).

Finally, the educational perspective sub-dimension was observed to have a small, significant, and negative relationship with displaced dissent(r = -0.099, p = 0.016 < 0.05). However, this sub-dimension was not significantly related to articulated dissent (r = -0.012, p = 0.769 > 0.05) or antagonistic dissent (r = -0.008, p = 0.843 > 0.05).

Discussion

The findings of this study are discussed in the context of relevant literature. In this framework, the results regarding educators' political socialization and organizational dissent, as well as the relationships between these variables, were examined in comparison with previous research.

First, the study investigated whether educators' branches of study created significant differences in their political socialization and organizational dissent. The analysis revealed that while branches significantly influenced political socialization levels, they did not create a significant difference in organizational dissent. Specifically, school administrators exhibited higher levels of political socialization than English teachers, classroom teachers, special education and counseling teachers, and physics, chemistry, biology, and vocational course teachers. This may be attributed to regulations regarding the selection and appointment of administrators, which are designed to ensure alignment with current political norms (Ulusoy, 2023). Consequently, administrators' political socialization levels are higher than those of some subject teachers.

No significant difference was found between educators' branches and organizational dissent, which aligns with Gürler's (2020) findings. However, the overall level of organizational dissent among educators was high, suggesting that educators are capable of voicing negative opinions openly, regardless of branch.

Given the recognized benefits of organizational dissent for institutional development, this represents a positive indicator for schools and the broader education system.

Union membership emerged as a significant factor influencing both political socialization and organizational dissent. Educators affiliated with The Educators' Union [Eğitim-Bir-Sen] and the Turkish Education, Teaching and Science Services Branch Public Employees' Union [Türk-Eğitim-Sen] exhibited higher political socialization than those affiliated with The Education Workers' Union [Eğitim-İş] or those without union membership. The authorized status of The Educators' Union [Eğitim-Bir-Sen] since 2010 and its close alignment with governmental and ideological structures explains both their elevated political socialization and relatively lower levels of organizational dissent compared to Education Workers' Union [Eğitim-İş] members (Duran, 2020). Educators who did not declare a specific union affiliation also exhibited higher political socialization than Education Workers' Union [Eğitim-İş] members, possibly due to a negative perception of union political alignment (Erkoç et al., 2022).

Regarding organizational dissent, members of the Education Workers' Union [Eğitim-İş] showed higher dissent levels than members of The Educators' Union [Eğitim-Bir-Sen]. This difference aligns with the founding objectives of Education Workers' Union [Eğitim-İş], which emphasizes democratic resistance and organizational ethics, supporting dissent as a legitimate expression against political power (Education Workers' Union, 2024).

Age also significantly affected both political socialization and organizational dissent. Educators aged 41–50 and over 50 displayed higher political socialization than those aged 31–40. Younger educators, still adapting to professional and cultural environments, may have lower acceptance of the political order (Kozikoğlu & Senemoğlu, 2018). For organizational dissent, educators aged 41–50 exhibited higher levels than younger educators, possibly due to fear of negative repercussions or inexperience in using dissent as feedback. Experience, therefore, appears to shape dissent behaviors.

The study found no significant differences in political socialization or organizational dissent based on the location of employment, school level, or type, which is consistent with some research (Korucuoğlu, 2016), though other studies indicate regional or school-level challenges may affect educators (Can, 2022; Korkmaz, 1999; Plessis & Mestry, 2019). This lack of difference can be partially explained by the altruistic and responsible personality traits of Turkish educators, as suggested by metaphors in Yıldırım et al. (2011). Similarly, school transportation conditions and educators' educational levels did not significantly influence political socialization or dissent, despite potential challenges such as financial burden or postgraduate study limitations (Başer et al., 2005; Demirel Yazıcı & Cemaloğlu, 2022).

Examining sub-dimensions, educators' perspectives on the political order were low, political interest was moderate, and perspective on education was moderate, resulting in moderate overall political socialization. While legally restricted from political engagement, educators still show political interest (Yurduseven, 2020), suggesting informed opinions on political and educational issues (İlkaya, 2016).

For organizational dissent, articulated dissent was high, antagonistic dissent moderate, and externalized dissent moderate. High levels of organizational dissent, particularly articulated dissent, are considered positive for organizational development (Kassing, 1997b; Yorulmaz, Çolak & Altınkurt, 2022). Critical thinking further supports this relationship (Ilıman Püsküllüoğlu & Altınkurt, 2018).

Correlation analyses revealed no significant relationship between political socialization and vertical or antagonistic dissent, while a weak negative relationship was observed between political socialization and externalized dissent, suggesting that less politically socialized educators may prefer expressing dissatisfaction outside the organization (Buckner, 2012; Kassing, 1997b). Further, political interest positively correlated with vertical and antagonistic dissent, whereas positive perceptions of the political order negatively correlated with all dissent types, highlighting that politically engaged educators tend to engage in constructive dissent. Evaluations of the education system negatively correlated with externalized dissent, indicating satisfaction reduces the need to share frustrations externally (Özpehlivan, 2018).

In summary, political socialization varied significantly with branch, age, and union affiliation, while organizational dissent remained generally high. Positive political perspectives were associated with lower

dissent, and politically interested educators demonstrated more constructive dissent behaviors, reflecting engagement and initiative in organizational problem-solving.

Recommendations

Based on the findings of this study, the following recommendations can be developed for policymakers, educational administrators, teacher education institutions, and researchers.

First, the findings show that educators' levels of organizational dissent are high and that articulated dissent, in particular, is a constructive process that contributes to institutional development. Accordingly, school administrators are advised to consider dissent not as a behavior that should be suppressed but as a part of organizational learning and development. A participatory and democratic organizational climate should be established in schools where teachers can express their opinions freely. Strengthening open communication channels, improving feedback mechanisms, and increasing teachers' participation in decision-making processes are important in this regard.

According to the findings, union membership has a significant effect on both political socialization and organizational dissent. Therefore, it is recommended that teacher unions take a more active role as stakeholders in the processes of developing and implementing educational policies. Dialogue mechanisms that will strengthen cooperation between school administrations and unions should be developed to support a culture of shared decision-making in educational institutions.

In line with the finding that age and professional experience increase both political socialization and organizational dissent, mentoring programs and professional learning communities should be established where experienced teachers can share their professional knowledge and critical perspectives with younger teachers. Such practices may contribute to the development of organizational awareness and constructive feedback skills among novice teachers.

The lack of significant differences based on contextual variables such as school type, location, transportation conditions, and education level suggests that teachers' individual awareness and organizational consciousness are more decisive. Therefore, in-service training programs should place greater emphasis on democratic leadership, critical thinking, organizational communication, and conflict management. Such training may contribute to the development of a culture of constructive dissent across different school contexts.

Considering the finding that teachers with higher levels of political interest display more constructive dissent behaviors, teacher education programs should include more courses and practices aimed at developing civic awareness, democratic participation, and critical thinking skills. In this way, teachers may be encouraged to demonstrate constructive, solution-oriented dissent behaviors that support institutional development.

Finally, future research should examine political socialization and organizational dissent across different educational levels, in different cultural contexts, and through the use of qualitative research methods. Such studies may increase the generalizability of the findings and provide a deeper understanding of the topic.

Conclusion

The findings indicate that educators' political socialization is influenced by variables such as field of study, age, and union membership, while organizational dissent appears largely independent of these factors. High levels of organizational dissent, particularly articulated dissent, represent a positive force for institutional development and reflect educators' critical thinking and engagement.

Union affiliation, particularly membership in the Educators' Union [Eğitim-Bir-Sen] or the Education Workers' Union [Eğitim-İş], plays a key role in shaping both political socialization and dissent behaviors, highlighting the influence of organizational alignment and ideological positioning. Age and experience contribute to both political socialization and dissent, with older educators exhibiting higher levels in both dimensions.

School-related factors, including location, type, and level, as well as transportation conditions and educational attainment, do not significantly influence political socialization or dissent, suggesting that educators' individual traits and organizational awareness may outweigh contextual differences.

Correlation analyses suggest that while political socialization and organizational dissent are largely independent, educators with greater political interest engage in constructive forms of dissent, such as vertical and antagonistic dissent, whereas those with a positive perception of the political order show reduced dissent. Evaluations of the education system similarly impact externalized dissent.

Overall, the study demonstrates that educators are capable of exercising critical, constructive dissent independently of their political socialization, and their engagement in organizational dissent contributes positively to the effectiveness and development of educational institutions.

Author's Note

This study is derived from the doctoral thesis entitled "Examination of Political Socialization and Organizational Dissent in Educators," written by Özgür Türk under the supervision of Prof.Dr. Sadık KARTAL.

CRediT authorship contribution statement

Turk, O: Conceptualization, Methodology, Data collection, Formal analysis, Investigation, Resources

Kartal, S: Supervision, Validation, Writing – original draft, Writing – review & editing

Declaration of Conflicting Interests

We declare that there is no conflict of interest regarding the research, authorship and/or publication of this article.

Ethics Approval and Consent to Participate

As of for the research, an ethics committee approval was obtained from Ethics Committee of Burdur Mehmet Akif Ersoy University dated 05.07.2023 and numbered GO 2023/412.

Declaration of AI Usage Statement

Artificial intelligence tools were not used in the data collection, data analysis, and data preparation of this study.

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|Research Article / Araştırma Makalesi|

An Investigation of Pre-School and Primary School Teachers' Views on Gamification, Intrinsic Motivation, and Learning in Education

Eğitimde Oyunlaştırma, İç Motivasyon ve Öğrenmeye Dair Okul Öncesi ve Sınıf Öğretmenlerinin Görüşlerinin İncelenmesi

Merve Şahin [1], Saliha Eren [2]

Keywords

Gamification in education

Intrinsic motivation

Preschool teacher

Primary school teacher

Abstract

This qualitative study aimed to examine and compare pre-school and primary school teachers' views on gamification in education, with a particular focus on intrinsic motivation and learning-related developmental outcomes. The study was designed as a multiple-case study and involved 30 teachers working in public schools in the central district of Çanakkale, Türkiye, including 15 pre-school teachers and 15 primary school teachers. Participants were selected through purposive sampling using typical case and maximum variation strategies. Data were collected through semi-structured face-to-face interviews conducted between February and April 2025. The interview data were analyzed using descriptive analysis and qualitative content analysis. The findings showed that teachers viewed gamification not merely as a tool for entertainment, but as a pedagogical approach that supports students' motivation, engagement, attention, self-confidence, and social interaction. Quest cards, badges, leaderboards, storytelling, and dramatization were among the most frequently mentioned practices. Teachers reported that gamification increased students' intrinsic motivation by enhancing willingness to participate, sustaining interest in activities, and making learning more enjoyable and memorable. The findings also revealed developmental differences between educational levels. Pre-school teachers emphasized sensory, movement-based, and dramatization-oriented applications, whereas primary school teachers highlighted more structured, task-based, and digitally supported practices. In addition, teachers stressed the importance of pedagogical alignment, technological infrastructure, material support, and practical teacher training for the effective implementation of gamification. Overall, the study suggests that gamification can be an effective and developmentally appropriate educational strategy when it is aligned with learning objectives and adapted to students' age-related needs. The study offers comparative qualitative evidence that may inform teachers, curriculum developers, and policymakers in designing more effective gamified learning environments.

Anahtar Sözcükler

Eğitimde oyunlaştırma

İçsel motivasyon

Okul öncesi öğretmenleri

Sınıf öğretmenleri

Öz

Bu nitel araştırma, eğitimde oyunlaştırmaya ilişkin okul öncesi ve sınıf öğretmenlerinin görüşlerini, özellikle iç motivasyon ve öğrenmeyle ilişkili gelişimsel çıktılar bağlamında incelemeyi ve karşılaştırmayı amaçlamıştır. Araştırma, çoklu durum çalışması deseninde tasarlanmış ve Çanakkale ili merkez ilçesindeki devlet okullarında görev yapan 15 okul öncesi öğretmeni ile 15 sınıf öğretmeni olmak üzere toplam 30 öğretmenle yürütülmüştür. Katılımcılar, tipik durum örneklemesi ve maksimum çeşitlilik örneklemesi kullanılarak amaçlı örnekleme yoluyla seçilmiştir. Veriler, Şubat–Nisan 2025 tarihleri arasında gerçekleştirilen yarı yapılandırılmış yüz yüze görüşmeler aracılığıyla toplanmıştır. Görüşme verileri betimsel analiz ve nitel içerik analizi ile çözümlenmiştir. Bulgular, öğretmenlerin oyunlaştırmayı yalnızca eğlence sağlayan bir araç olarak değil, öğrencilerin motivasyonunu, derse katılımını, dikkatini, öz güvenini ve sosyal etkileşimini destekleyen pedagojik bir yaklaşım olarak gördüklerini göstermiştir. Görev kartları, rozetler, liderlik tabloları, hikâyeleştirme ve drama en sık belirtilen uygulamalar arasında yer almıştır. Öğretmenler, oyunlaştırmanın öğrencilerin derse katılma isteğini artırarak, etkinliklere olan ilgiyi sürdürerek ve öğrenmeyi daha eğlenceli ve kalıcı hâle getirerek iç motivasyonu güçlendirdiğini ifade etmiştir. Bulgular ayrıca eğitim kademelerine göre gelişimsel farklılıklar olduğunu ortaya koymuştur. Okul öncesi öğretmenleri duyusal, hareket temelli ve drama odaklı uygulamaları vurgularken, sınıf öğretmenleri daha yapılandırılmış, görev temelli ve dijital olarak desteklenen uygulamalara dikkat çekmiştir. Ayrıca öğretmenler, oyunlaştırmanın etkili biçimde uygulanabilmesi için pedagojik uyumun, teknolojik altyapının, materyal desteğinin ve uygulamaya dönük öğretmen eğitiminin önemini vurgulamıştır. Genel olarak araştırma, oyunlaştırmanın öğrenme hedefleriyle uyumlu ve öğrencilerin yaşa bağlı gereksinimlerine uygun biçimde düzenlendiğinde etkili ve gelişimsel olarak uygun bir eğitim stratejisi olabileceğini göstermektedir. Bu çalışma, daha etkili oyunlaştırılmış öğrenme ortamlarının tasarlanmasına yönelik olarak öğretmenlere, program geliştiricilere ve politika yapıcılara katkı sunabilecek karşılaştırmalı nitel bulgular ortaya koymaktadır.

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Introduction

Education in the 21st-century still has its paradigm as the core objective of granting not only access to students but also ensuring their active, willing and meaningful participation in the learning process. A considerable number of studies have found that educational settings should abandon their old roles of being mere information transmission venues and become structures that encourage student active involvement, collaboration, and high engagement (Deterding et al., 2011; Kapp, 2012). The change is very important, particularly when it is about acquiring 21st-century skills. Educational processes have to be changed in such a way that students are not only provided with cognitive skills but also social, emotional, and creative competencies. In this regard, attracting students' attention and developing their natural learning motivation have become the most important issues in contemporary pedagogy. Gamification, an innovative method, invented as a solution to this problem, is the incorporation of game elements and mechanics into non-game contexts and has lately been the focus of a lot of the education sector's attention (Mårell-Olsson, 2022; Xu & Sukavatee, 2025).

Definitely, the insertion of game elements such as badges, leaderboards, quests, and storytelling into the educational processes can have a significant impact on students' behavior. They become more engaged, cooperative, and if they want to achieve their goals, they will dedicate more of their time and effort (Alenezi, 2023; Vázquez-Cano et al., 2023). Gamification is generally considered as an effective method with a wide range of possibilities that can be applied to various types of learners starting from the pre-school stage and going up to adult education level. As the effectiveness of traditional teaching methods gradually fades and they become unable to attract the students' attention for a long time, gamified applications revive the learning process by making it more fun, interactive, and motivating, so they can be seen as the best way to keep the students' involvement going (Eren, 2025). The core reason for this method is to elevate the students' internal motivation, broaden their attention capacity, and make learning more valuable.

From a theoretical standpoint, “intrinsic motivation” refers to engaging in learning activities because they are inherently interesting and satisfying rather than because of external pressure or rewards. Self-Determination Theory (SDT) explains intrinsic motivation through the satisfaction of three basic psychological needs—autonomy, competence, and relatedness—and emphasizes that learning environments supporting these needs tend to foster deeper engagement, persistence, and well-being (Ryan & Deci, 2000). In educational gamification, game elements (e.g., meaningful choices, optimal challenges, feedback, collaboration) can be designed to satisfy autonomy/competence/relatedness and thereby strengthen intrinsic motivation; however, SDT also warns that controlling, purely reward-focused designs may undermine intrinsic motivation by shifting students’ focus from the joy/meaning of learning to “earning points or badges” (Deci et al., 1999). Empirical work likewise shows that specific game design elements have distinct psychological effects (e.g., leaderboards/badges may increase competence signals, while narratives/teammates may enhance relatedness), highlighting that motivational outcomes depend on how gamification is designed, not merely whether it is used (Hanus & Fox, 2015; Sailer et al., 2017).

Learning environments enabled by gamification give students the opportunity to keep their attention for longer periods, develop positive attitudes towards the learning process, and reach higher levels of cognitive learning (Domínguez et al., 2013). Besides, particularly, if we take the developmental characteristics of children into consideration, play-based learning triggers processes such as exploration, curiosity, trial-and-error learning, and gaining experience through direct contact, thus it not only diversifies the learning process but also supports cognitive and emotional development concurrently. In early childhood education specifically, research on guided play suggests that playful, child-centered exploration supported by adult scaffolding can promote meaningful learning while remaining developmentally appropriate, making it a strong pedagogical bridge between “free play” and “direct instruction” (Weisberg et al., 2013). The studies come to the conclusion that gamification has the potential to deliver long-term advantages to the learning process if it is created not only with the intention of providing fun but also with a meaningful, goal-oriented and pedagogically sound purpose. Learning environments created with game elements not only help students to realize their potential more as they get deeply involved in the learning process but also, at the same time, they are able to maintain their learning motivation at a high level (Zainuddin et al., 2020). Gamification, with these characteristics, might be an effective way of fulfilling the developmental requirements of students, particularly those in primary and pre-school education, as it has the capability of doing so.

The place of gamification in pre-school education should be conceptualized through a “play-first” lens: children’s learning is strongly intertwined with play, curiosity, and socio-emotional interaction, so gamification is most developmentally appropriate when it enriches play-based routines rather than replacing them with rigid competition or excessive pointification (Weisberg et al., 2013; Zeybek & Saygı, 2024). In practice, pre-school gamification tends to emphasize short, concrete challenges, immediate and supportive feedback, visual/embodied rewards (e.g., stickers, stars, classroom missions), and collaborative story-based tasks that can nurture language, self-regulation, and peer interaction. Studies in Türkiye also indicate that digital tools in early childhood can increase participation and enable “gamification” affordances (e.g., diversified content, engagement, instant feedback), but they simultaneously raise concerns about pedagogy, adult guidance needs, unequal access, and the risk of reduced hands-on concreteness if technology dominates (Başalev-Acar & Bedel, 2024). Therefore, a key advantage at the pre-school level is increased engagement and sustained attention, while a key disadvantage/risk is undermining intrinsic interest or developmental appropriateness when rewards become controlling or when screen-based activities weaken hands-on, social play experiences (Başalev-Acar & Bedel, 2024; Deci et al., 1999).

In primary school, gamification can be positioned as a complementary instructional strategy aligned with more structured curricular goals (e.g., practice, mastery, formative feedback, and progression). Teacher- and student-focused studies in Türkiye show that gamified/game-based mathematics practices are often valued for supporting cognitive gains such as meaningful learning, retention, and the concretization of abstract concepts, while also being perceived as motivating and attention-grabbing (Deringöl & Değirmenci, 2024; Ergül & Erşen, 2023). At the same time, teachers frequently note implementation risks such as classroom management challenges, time constraints, and competition-related tensions (Arslan et al., 2023; Ergül & Erşen, 2023). Thus, primary-level advantages include increased practice engagement, faster feedback cycles, and opportunities for collaboration; potential disadvantages include over-competition, social comparison pressure, and motivational “crowding out” if rewards are experienced as controlling rather than informational (Deci et al., 1999; Hanus & Fox, 2015).

Gamification is less like a traditional or digital game and more like an educational approach that aims to make learning more attractive, interactive, and centered on the learner through the integration of core-gaming dynamics (e.g., scoring, reward systems, leveling up, task completion, leaderboards, etc.) into non-game contexts, especially the educational ones (Kapp, 2012; Werbach & Hunter, 2012). Although the concept of gamification in education is mostly associated with digital apps, it is recognized that different gamification frameworks based on reward and competition were used in educational environments before the time when technology became highly developed. For instance, the implementation of ribbons, stars, and smileys as visual rewards that has been a popular classroom tool for motivating students, which means that the educational roots of gamification go back quite long. Gamification is not a digital-dependent concept. Game mechanics can still be used in physical classrooms. The strategies in which teachers give points to students for completed tasks during the lesson, students get rewarded when reaching a certain number of points, or activities facilitating the competition and collaboration of groups are ways in which gamification can be effectively employed (Eren, 2025).

Based on research, the use of gamification in education is viewed as a complex multi-level strategy that enhances not only students' motivation but also entails features such as the active engagement of students, facilitation of social interaction, and encouragement of individual self-regulation skills (Koivisto & Hamari, 2019; Looyestyn et al., 2017). Excellence in behaviors during gamification processes, if accompanied with feedback that shows recognition, not only extends the feeling of accomplishment but also makes motivation long-lasting. Meanwhile, if negative behaviors are given constructive feedback in a way that provides some clues for changing the behavior rather than giving criticism directly, the recipients can turn their errors into learning opportunities. Such intentional feedback involves the learner more deeply in the process as it elevates their need for self-improvement (Yılmaz, 2022). These types of learning environments which involve game elements improve skills like listening, willing participation in the learning process, and the use of cognitive strategies especially in the case of children of preschool and primary school age. Gamified learning environments enable learners to reach longer attention spans, develop positive attitudes toward the lesson, and establish more lasting cognitive representations related to the learning content (Domínguez et al., 2013; Sailer & Homner, 2020). Empirical studies with school-aged learners suggest that gamified or game-based implementations can be associated with increased confidence-related outcomes (e.g., perceived competence) and, in some contexts, academic self-efficacy—although results may vary depending on design and measurement (Li & Chu, 2021; Önal & Çeltek, 2023; Rachels & Rockinson-

Szapkiw, 2018) Furthermore, game-based applications can also have a positive impact on children's confidence which, in turn, leads to the raising of their self-efficacy beliefs and makes a positive contribution to their socio-emotional development (Kubota et al., 2024)

The possibility to give prompt feedback is one of the most beneficial aspects of gamification in education. In traditional education students are generally given feedback only after the release of exam or assignment results. However, gamified systems make learning a continuous and cyclical process which in turn allows for quick error detection and correction (Domínguez et al., 2013). This not only doubles the learning speed but also removes the fear of making mistakes, thus having a positive impact on students' attitudes towards the lesson. Furthermore, gamification provides teachers with an opportunity to follow students' progress at a glance which in turn makes organizing lessons easier and opens up the possibility for creating personalized learning experiences. In particular, the use of gamification can be considered as a powerful tool to raise motivation among students who have low motivation and to help students with learning difficulties acquire a more positive and sustainable attitude towards learning (Hanus & Fox, 2015).

The literature review reveals a huge number of studies backing the positive effects of gamification on the motivation of students, long-term learning, and self-confidence (Helvich et al., 2023; Romero Rodrigo & López Marí, 2021). The proper use of gamification, especially in early childhood and primary school, is primarily the focus of today's research, which has significant contributions of the method not only to the emotional and social students' development but also to their cognitive development (Rahmawati, 2024; Wahab, 2025). These studies position gamification as a powerful device to be used in the immersion of learning in a more pleasurable way and also in the process of turning intangible concepts into concrete ones (Deringöl & Değirmenci, 2024; Ergül & Erşen, 2023). However, the success of gamification mainly depends on the teacher's standpoint, their teaching style, and their ability to carry it out. Teachers' attitude towards gamification, the strategies they use and why, and how they feel about the impact of the process on students are the factors that matter the most in understanding the effectiveness of the approach. A huge body of literature based on teachers' opinion of gamification reveals that gamification skills improves not only academic but also cognitive, social, and emotional development of students. In the wide-ranging study by Vázquez-Cano et al. (2023), teachers voiced that gamification is the key that students use for opening the doors of their problem-solving, self-regulation, collaboration, and motivation skills enhancement.

Essentially, Alenezi (2023) expressed that one of the major benefits of gamification powered by artificial intelligence is a student's learning outcomes, knowledge retention, and focus. While interviewing primary and secondary school teachers, Mårell-Olsson (2022) discovered the effectiveness of gamification in the case of fair interplay between purposeful learning and fun. Differently, based on primary school teachers' opinion in China, Xu and Sukavatee (2025) argued that gamification as opposed to traditional learning methods is only effective in certain areas like vocabulary and reading skills, while it may cause distraction if there is no strong connection with the curriculum. Regarding the social aspect of development, besides Batlle and González (2023) also Romero Rodrigo and López Marí (2021) stated that teachers notice the contribution of gamification in collaboration, in-group interaction, and positive class atmosphere formation. Particularly in the research of Batlle and González (2023) with adult foreign language teachers, social bonding and interactive learning environment building were the areas where gamification was seen as most helpful. Emotionally speaking, the research of Helvich et al. (2023) and Alenezi (2023) came to the conclusion that teachers perceive gamification as a means which not only motivates students but also makes them develop positive attitudes towards learning and facilitates fast and easy learning too. The research of Vrcelj et al. (2023) revealed gamification to be the cause of great classroom participation, which, in turn, was the success factor for teaching willingness to learn and self-confidence. Khaldi et al. (2023) note that the foremost gamification elements in online learning environments at the tertiary education level are points, badges, leaderboards, and feedback, and over the last few years, there has been a gradual move towards deeper elements like narrative (storytelling) and challenge.

Still, most of the studies in this area are carried out without any theoretical backing. Mao and Lucas (2025), while discussing gamification in their recent paper, admit that gamification influences various aspects of education like motivation, engagement, and learning retention. They refer to the elements of the game that encourage students' involvement, such as tasks, badges, and leaderboards. The research maintains that if these tools are purposely used to achieve teaching objectives, then it is possible to see a significant rise in students' learning outcomes.

According to the teachers, for gamification to work effectively, among other things, consideration of, curriculum alignment, adherence to pedagogical objectives, teacher training, technology environment, and institutional support, should be taken into account (Helvich et al., 2023; Romero Rodrigo & López Marí, 2021; Xu & Sukavatee, 2025). Here, it is clear that implementations without adequate technical support and professional development programs for educational software users have little influence. Referring to the problems of implementation, teachers reported that they face various kinds of obstacles such as time shortage, lack of resources, technical issues, and difficulties in pedagogical integration (Mårell-Olsson, 2022; Vázquez-Cano et al., 2023). Moreover, there have been cautions about the danger of too much individualization or exclusion that may be the result of competition-based gamification applications (Romero Rodrigo & López Marí, 2021).

In Türkiye, the literature includes both perception-focused and implementation-focused work: classroom teachers' views on gamification (Arslan et al., 2023), primary learners' perspectives on learning mathematics through games/gamified experiences (Deringöl & Değirmenci, 2024), and primary teachers' accounts of advantages (e.g., cognitive gains, meaningful learning, concretization) and disadvantages (e.g., classroom management) in gamified/game-based mathematics practices (Ergül & Erşen, 2023). In early childhood contexts, studies highlight how digital technologies may support engagement and "gamification" affordances but also introduce pedagogical and equity concerns requiring careful guidance (Başalev-Acar & Bedel, 2024), and experimental/implementation studies also exist in pre-school settings (Civelek Bayraktar & Öz, 2024). Internationally, systematic reviews indicate a growing body of K–12 gamification research, yet findings remain context-dependent and design-sensitive, with calls for better-aligned, theory-informed implementations (Dehghanzadeh et al., 2023; Zeybek & Saygı, 2024). However, studies that directly compare pre-school and primary school teachers' views particularly through the joint lens of gamification, intrinsic motivation, and learning/developmental outcomes remain limited, which motivates the comparative focus of the present study. In fact, research in this area has, up to now, overlooked a large gap that raises a question about the impact of the technology implementation on students of various ages. First of all, it is extremely difficult to find any literature review that compares the different studies which examine how children of different ages understand gamification, especially between the preschool period when play-based learning is still the most reasonable and primary school period where structured academic goals are getting more and more dominant. Therefore, there is a need for comparative qualitative evidence capturing how teachers at these two levels conceptualize (i) developmentally appropriate gamification approaches, (ii) the cognitive–emotional–social developmental implications of gamified activities, and (iii) the role of gamification in fostering intrinsic motivation under different curricular and classroom constraints (Arslan et al., 2023; Dehghanzadeh et al., 2023; Ergül & Erşen, 2023). There is a necessity for a comparative survey of preschool and primary school teachers regarding their use of gamification as a technique which is in line with the cognitive, emotional, and social needs of different age-related groups; which elements they focus on and their roles in fostering intrinsic motivation in order to get over this research gap.

The secondary masked objective of this research was to discover teachers' views of pre-school and primary school through the lens of gamification at the comparative level and beyond the surface. Besides teacher viewpoints, the intrinsic motivation, engagement, and learning process, as well as the developmental domains of students, were thoroughly explored in connection with the implementation of gamification methods. Furthermore, faculty strategies in the use of gamification, apart from the variations in the execution of age-related gender groups as well as their suggested developmental paths to make this process more efficient, were investigated in this study. This study aims to theoretically contribute and give real, evidence-based, teachers-at-different-educational-levels-, curriculum developers-, and policymakers-directed- suggestions for gamification that is developmentally appropriate and effective.

Problem statement. Despite the increasing adoption of gamification in education, there is still limited comparative qualitative evidence on how pre-school and primary school teachers conceptualize gamification in relation to (a) students' intrinsic motivation and (b) cognitive, emotional, and social learning/developmental outcomes, as well as how these views shape age-appropriate classroom practices.

Thus, the study aims to find answers to the research questions listed below:

- How do pre-school and primary school teachers perceive the incorporation of gamification in educational settings?

- How do teachers interpret the correlation between gamification activities and students' cognitive, emotional, and social growth?
- Where do differences lie regarding teachers' chosen gamification techniques, tactics, and age-specific resources?
- What kind of assistance would teachers be most appreciative in the gamification process?

Method

Research Design

The current study was a qualitative study, where the researchers aim to clarify the views of pre-school and primary school teachers about the use of gamification and intrinsic motivation in education. A qualitative research approach, which concentrates on uncovering the personal significances of individuals' experiences, was selected for this study (Yıldırım & Şimşek, 2018). Therefore, the research model was converted into a case study design. Case studies offer the ways for in-depth investigation of a particular event, process, or group of people (Creswell, 2012). Since this research was directed at the orderly and comparative handling of the experiences of different participant groups (pre-school and primary school teachers) concerning gamification and motivation, a multiple-case study design was used (Stake, 1995).

Participants

The teacher participants were thirty in total, i.e., 15 pre-school teachers and 15 primary school teachers from the central district of Çanakkale province. The participants were chosen by purposive sampling methods of typical case sampling (Büyüköztürk et al., 2012) and maximum variation sampling (Patton, 2002). The sample consists of 30 teachers working in state schools affiliated with the Ministry of National Education in the central district of Çanakkale province. Among them, 15 are primary school teachers, and 15 are pre-school teachers. Participants' demographic characteristics (branch, gender, and age) are summarized in Table 1. Regarding gender, pre-school teachers 9 were female, 6 were male whereas among primary school teachers 12 were female and 3 were male; thus, the overall sample consisted of 21 female and 9 male participants (Table 1). The analysis of the age distribution of the participants shows that 10.0% (n = 3) were between 23–30 years old, 30.0% (n = 9) were between 31–40 years old, 30.0% (n = 9) were between 41–50 years old, and 30.0% (n = 9) were 51 years old and over (Table 1). This distribution offers a chance to assess the opinions of gamification and intrinsic motivation more widely through different age groups' experiences in the research. Overall, the heterogeneous demographic profile supports the logic of maximum variation sampling by enabling the exploration of teachers' views across diverse backgrounds (Patton, 2002).

Table 1

Demographic Characteristics of the Teacher Participants

Variable	Category	n	%
Branch	Pre-school teacher	15	50.0
	Primary school teacher	15	50.0
Gender	Female	21	70.0
	Male	9	30.0
Gender × Branch	Pre-school: Female	9	30.0
	Pre-school: Male	6	20.0
	Primary: Female	12	40.0
	Primary: Male	3	10.0
Age range (years)	23–30	3	10.0
	31–40	9	30.0
	41–50	9	30.0
	51+	9	30.0

Data Collection Instrument

The questions were developed by considering the literature and similar studies examining teachers' views on gamification (Arslan et al., 2023; Mårell-Olsson, 2022; Yaşar et al., 2020). In addition, recommended procedures for developing and refining semi-structured interview guides were followed (Castillo-Montoya, 2016; Kallio et al., 2016). For content validity, three field experts and one qualitative research expert were consulted. Two of the field experts had expertise in Early Childhood Education and one field expert had expertise in Primary Education/Classroom Teaching; the qualitative research expert provided methodological feedback on the structure and clarity of the interview form. Experts' recommendations were taken into account for simplifying the language of the questions and changing their sequencing. A pilot implementation was also conducted with 12 teachers who met the inclusion criteria but were not included in the main study sample (6 pre-school teachers and 6 primary school/classroom teachers). The pilot interviews were used to check question clarity, flow, and approximate duration, and minor revisions (e.g., rewording, adding probes, and re-ordering questions) were made accordingly (Castillo-Montoya, 2016; Kallio et al., 2016). The modifications made in this process contribute to the validity and reliability of the research and support the trustworthiness of the data collection procedure (Miles & Huberman, 1994; Tong et al., 2007).

The final form of the semi-structured interview questions used in the study is presented below:

- What are your general views on gamification in education, and what can you say about its main components?
- How do you implement gamification in your lessons/activities? Which methods do you prefer?
- How do you evaluate the effects of gamification on students, particularly in terms of their intrinsic motivation?
- What methods do you use to increase students' intrinsic motivation? What role does gamification play in this respect?
- What are your views on the contributions of intrinsic motivation to the learning process? Could you explain these contributions with concrete examples?
- How do you think gamification affects the enhancement of intrinsic motivation? What does the feedback you receive from your students suggest in this regard?
- To what extent do you think gamification practices are sufficient to increase student motivation? Which methods have produced more successful results?
- What are your suggestions for making gamification in education more effective? In the contexts of pre-school and primary education, what differences do you observe in the effects of these practices?

Data Collection Procedure

The interviews took place after the participants voluntarily agreed to take part in. Ethics committee approval for this study was obtained from the Çanakkale Onsekiz Mart University Graduate Education Institute Scientific Research and Publication Ethics Committee (Date: 09.01.2025, Decision No: 01/86), and voluntary informed consent was obtained from all participants in accordance with the Declaration of Helsinki. All interviews were conducted face-to-face in a quiet room at the participants' schools meeting room in the central district of Çanakkale. The data collection was carried out between February and April 2025. Every teacher was individually interviewed for around 25-30 minutes on average, and the interviews were audio-recorded. The researchers made a word-by-word transcription of the audio recordings and a unique code was assigned to each participant instead of their name to provide anonymity (e.g., OI - Pre-school Teacher, S1 - Primary School Teacher 1). The names of the people who took part in the research were kept secret according to the ethical standards.

Data Analysis

The qualitative data collected were analyzed using descriptive analysis and qualitative content analysis. Descriptive analysis involved organizing and presenting the findings under thematic headings aligned with the research questions and supporting each theme with direct quotations from participants (Yıldırım & Şimşek, 2018). Qualitative content analysis was conducted through a systematic, step-by-step coding process based on a coding-frame approach (Schreier, 2012) and rule-guided category development (Mayring, 2014). The analysis was carried out through a systematic, step-by-step procedure. First, all audio recordings were transcribed verbatim by the researcher, identifying information was removed, and each participant was assigned a unique code to ensure anonymity. Next, the transcripts were read repeatedly to develop familiarity with the dataset and to identify text segments relevant to the research questions. Each full interview transcript was then treated as the main unit of analysis; for coding, relevant text segments (coding units) were determined and interpreted within their surrounding context to prevent meaning loss (Mayring, 2014). Following this, relevant segments were highlighted and labeled with initial codes, and coding was conducted iteratively across transcripts. Codes were subsequently compared and organized into a coding-frame with clearly defined categories and subcategories; category definitions and inclusion–exclusion rules were refined to improve consistency (Schreier, 2012). The coding frame was then applied to the full dataset and revised when necessary (e.g., merging similar categories, splitting overly broad categories, clarifying definitions), and the codebook was updated accordingly (Schreier, 2012; Mayring, 2014). After coding was finalized, categories and subcategories were abstracted into broader themes aligned with the research questions, and frequencies were calculated to indicate how often categories/themes were referenced across participants. To enhance dependability, the primary coding was conducted by the researcher (first author) and an independent qualitative research expert independently coded a sample of transcripts using the same coding frame; inter-coder reliability was calculated using the Miles and Huberman (1994) formula [Agreement / (Agreement + Disagreement) × 100], and agreement exceeded 90%, with disagreements resolved through discussion and the codebook finalized. Finally, findings were reported by presenting each theme/category with a clear definition and supporting it with representative quotations to ensure transparency and traceability from data to interpretation (Yıldırım & Şimşek, 2018).

Validity and Reliability

Validity and reliability are, without a doubt, two of the most significant attributes that influence the exactness and the level of trust of qualitative research findings. In this study, trustworthiness was addressed through the criteria of credibility and transferability (as well as dependability and confirmability) (Lincoln & Guba, 1985; Shenton, 2004). For credibility (internal validity), member checking was conducted by sharing brief interview summaries with participants and incorporating their confirmations/corrections where needed. Credibility was further strengthened through investigator/peer debriefing procedures: the primary coding was conducted by the researcher and an independent qualitative research expert reviewed a subset of transcripts and coding decisions, and discrepancies were discussed until consensus was reached. Inter-coder agreement exceeded 90% using the Miles and Huberman (1994) formula, supporting the dependability of the coding process. In reporting the findings, direct quotations were used to provide evidence for categories and themes and to enhance transparency (Tong et al., 2007). For transferability (external validity), thick description was provided by detailing the research context (public schools in the central district of Çanakkale; face-to-face interviews conducted between February and April 2025 and by reporting participants' demographic characteristics (branch, gender, and age) in Table 1. In addition, purposive sampling (typical case and maximum variation) was used to include teachers with diverse profiles, enabling readers to judge the applicability of findings to similar settings (Patton, 2002; Shenton, 2004). Finally, confirmability was supported by maintaining an audit trail of data collection and analysis decisions (e.g., interview guide revisions, codebook iterations, and theme development steps) and by ensuring anonymity through participant codes.

Researcher's Role

The research was quite interventionist in that the researcher was not only the data collector but also the data analyst. This situation is due to the researcher being involved in qualitative research as a facilitator (Creswell, 2012). During the researchers' interview sessions, the interviewers continued the sessions without the researchers'

interference, they raised reflective questions which were aimed at getting the participants to expand their ideas and in addition, they maintained their neutrality.

Findings

Qualitative data from in-depth interviews conducted in line with the study's aim were analyzed by descriptive and content analysis methods. The teachers' lived experiences, their perceptions, and the pedagogical approaches they employed were the features that were extracted from their interviews, organized thematically, and reflected the role of gamification and intrinsic motivation in the learning processes. The tables display the thematic categorization of the coding of the participants' utterances along with literature-based classifications. Each theme is provided with the corresponding sub-themes, participant codes, frequencies, and representative extracts.

Table 2 summarizes the themes and sub-themes derived from teachers' definitions of gamification, together with the contributing participants, frequencies, and supporting views.

Table 2

Thematic Analysis of Teachers' Definitions of Gamification

Theme	Sub-Theme	Participants	Frequency	Supporting View
Motivation and Engagement	Interest and Interaction in the Lesson	S4, S10–S15, O1, O3, O4, O6, O9–O12	14	"Participation increased with the badge and quest system." (S11)
Permanent Learning and Enjoyable Process	Learning Retention	S1–S3, S6, S8, O1–O3, O5, O10, O13–O15	14	"Children learn more permanently while having fun." (O2)
Components of Gamification	Quest, Badge, Score	S5, S9, S11, S12, S15, O1, O11, O12, O15	9	"The leaderboard and badges increased interest." (O11)
Cognitive and Social Alignment	Concretization, Appropriateness	S9, O6, O7, O10, O13, O14	6	"Abstract concepts cannot be learned without play." (S14)
Creativity and Dramatization	Drama and Role-Playing	O7	1	"They learned while having fun with role-playing activities." (O7)

Table 2 shows the definitions of gamification by pre-school and primary school teachers, who were the participants of the research, have been categorized into five different themes: Motivation and Engagement, Permanent Learning and Enjoyable Process, Components of Gamification, Cognitive and Social Alignment, and Creativity and Dramatization. The teachers indicated the theme "Motivation and Engagement" most frequently. In this sense, it was said that the badge and quest systems not only attracted students to the lesson but also interaction was led to a higher level. As an example, a primary school teacher, S11, stated, "Participation increased with the badge and quest system".

Likewise, the topic of "Permanent Learning and Enjoyable Process" was also frequently mentioned. The participants asserted that, when playing as a method of learning, children do not only have fun but also the information they learn stays with them for a longer time. This opinion finds support in the statement, *"Children learn more permanently while having fun*" (O2). In the subject "Components of Gamification," the idea of how structured tools such as quests, badges, and scores influence children's willingness to participate in the lesson is highlighted. The statement, "*The leaderboard and badges increased interest*" (O11), makes direct reference to these functional tools. With regard to the theme "Social and Cognitive Alignment," the authors expressed the idea that play can facilitate understanding of even the most difficult concepts, especially for children in the concrete operational stage. One teacher noted this by saying, "*Abstract concepts cannot be learned without play*" (S14). Eventually, the theme "Creativity and Dramatization," a topic addressed by a single teacher, indicates the idea that gamification helps in stimulating creative thinking and improving expression skills. Pre-school teacher O7 was of the opinion that, "*They learned while having fun with role-playing activities*".

Table 3 presents the themes and sub-themes derived from teachers' views on how gamification affects intrinsic motivation and course engagement, together with the contributing participants, frequencies, and supporting views.

Table 3

Teacher Views on the Effect of Gamification on Intrinsic Motivation and Course Engagement

Theme	Sub-Theme	Participants	Frequency	Supporting View
Increase in Intrinsic Motivation	Motivation and Willingness	S1, S5–S7, S9, S11, S13–S14, O1, O3–O10, O15	18	"Students become more motivated in the process thanks to gamification." (S9)
Increase in Course Engagement	Active participation in the process	S4, S7, S8, S11–S13, O5, O9, O11, O14, O15	11	"They do not want to leave the classroom without completing the task." (O14)
Positive Emotional Feedback	Fun, satisfaction, desire to repeat	S4, S10, S13, O3, O10–O13, O15	9	"Will we play this game again tomorrow?" (O3)
Permanent and Enjoyable Learning	Unforgettable, enjoyable learning	S1, S6, S9, S13, O3, O6, O12	7	"It is observed that children are having fun and not getting bored." (O1)
Self-Confidence and Self-Expression	Self-confidence, power of expression	S2, S3, S14, O1, O2, O7, O8	7	"They express themselves better through play." (S14)
Sense of Curiosity and Exploration	Curiosity, attention, interest	S3, S6, S9, O3, O4, O6	6	"Games reinforce children's curiosity." (O6)

The teachers' perspectives on the influence of gamification on students' intrinsic motivation and course engagement are summarized in six main themes in Table 3. The largest number of times the theme "Increase in Intrinsic Motivation" was mentioned; 18 in total the participants stated the increase of student willingness and motivation because of gamification within this theme. For instance, a primary school teacher S9 shared the idea, "Thanks to gamification students actually become more motivated in the process". In the theme "Increase in Course Engagement", 11 members of the panel voiced the opinion that gamification made students active participants of activities. Pre-school teacher O14 provided an example of such a situation by saying, "They definitely will not leave the classroom without finishing the task". In the theme "Positive Emotional Feedback" 9 participants mentioned that students gave both verbal and behavioral feedback indicating the enjoyment of the experience. Pre-school teacher O3 described the situation with the sentence, "Will we play this game again tomorrow?". The theme "Permanent and Enjoyable Learning" was the point of view of 7 participants; the teachers confirmed that students not only enjoyed but also learned during the game process. O1 said, "It is brought to light that children are having fun and not getting bored". Seven members of the panel, in the "Self-Confidence and Self-Expression" category, pointed out that students felt more comfortable to express themselves. Teacher S14 employed the expression, "*They express themselves better through play*". The theme "Sense of Curiosity and Exploration" had six mentions by participants. Teacher O6 shared the idea, "G*ames reinforce children's curiosity".*

To address teachers' interpretations of gamification in relation to students' developmental domains, the thematic structure (cognitive, emotional, and social) is summarized in Table 4 with participant distributions and frequencies.

Table 4

Teacher Views on the Effect of Gamification on Developmental Domains

Theme	Sub-Theme	Participants	Frequency	Supporting View
Cognitive Development	Knowledge Retention, Attention, Self-Efficacy	S1, S5, S6, S7, S8, S9, S10, S14, O1–O4, O6–O7, O9–O10, O13–O15	18	"They learn faster and more permanently." (O7)
Emotional Development	Happiness, Self-Confidence, Emotional Affirmation	S2–S4, S6, S10, S13–S14, O1–O3, O6–O8, O10–O12	16	"The child is unaware that they are learning while playing." (O2)
Social Development	Sharing, Taking Responsibility, Cooperation	S2, S4, S11–S12, S15, O1, O4, O6, O10–O11, O13–O14	12	"Children are more successful because they feel they belong to the group." (S2)

Table 4 details the classification of students' developmental effects stemming from gamification practices into three major themes. The "Cognitive Development" theme was leading in terms of the number of times it was referred to. As a matter of fact, 18 participants in total mentioned that gamification influenced positively their

cognitive skills such as knowledge retention, attention span, and self-efficacy. One of the statements of a Pre-school teacher O7 was, “They learn faster and more permanently”. The "Emotional Development" theme was represented by 16 participants. Educators declared that gamification applications empowered students to experience happiness, self-confidence, and positive affect among other areas. Teacher O2 stated, “The child is unaware that they are learning while playing”. The "Social Development" theme was mentioned by 12 participants; they stated that through gamification social skills such as sharing, taking responsibility, and helping had been enhanced. Teacher S2 explained this case with the sentence, “Children are more successful because they feel they belong to the group”.

Table 5 outlines the gamification methods teachers reported using most frequently across pre-school and primary school levels, together with implementation strategies and developmental considerations.

Table 5

Most Preferred Gamification Methods Based on Age Groups

Theme	Sub-Theme	Participants	Frequency	Supporting View
Gamification Methods	Quest Cards, Badge, Storytelling, Drama	S3–S4, S11–S14, O1, O3–O5, O7, O11–O14	12	“Quest + storytelling was the most successful method.” (O14)
Strategy and Implementation Style	Score, Competition, Post-Story Quest, Activity	S6, S9, S11, S12, S14, O3, O6, O7, O9, O14	10	“I draw attention with the score and quest system.” (S12)
Material Use	Station, Wheel, Surprise Box, Outdoor Games	S6, S10, O6, O10, O14–O15	6	“Participation is higher in outdoor games.” (S10)
Age and Developmental Differences	Concrete – Abstract Applications, Rhythm vs. Digital System	S2, O1, O3, O4, O5	5	“Sensory activities are effective in pre-school, digital activities in primary school.” (O1)

According to Table 5, the teachers use of gamification to increase students’ intrinsic motivation was broken down into four themes. Twelve participants expressed the theme “Gamification Methods”. The methods of quest cards, badges, storytelling, and drama were identified as effective. Teacher O14 shared, “Quest + storytelling was the most successful method”. Within the “Strategy and Implementation Style” theme, 10 participants mentioned that scoreboards, elements of competition, post-story quests, and various activities made students concentrate. S12, as an instance of this, stated, “I draw attention with the score and quest system”. The 'Material Use' theme was referred to by 6 participants. They claimed that station work, wheels, surprise boxes, and outdoor games raised student involvement. Participant S10 made the statement, “Participation is higher in games played in the yard”. The theme “Age and Developmental Differences” was emphasized by 5 participants. The notion that tools and methods for pre-school and primary school should be different was most prominent. Teacher O1, by saying, “Sensory activities are effective in pre-school, digital activities in primary school”, indicated age appropriateness.”

Table 6 summarizes teachers’ reported support needs for implementing gamification, ranging from training and materials to age-appropriate planning and learning-goal alignment.

Table 6

Views on Teachers’ Support Needs

Theme	Sub-Theme	Participants	Frequency	Supporting View
Teacher Training and Awareness	Applied training, university courses, summer camps	S1, S7, O4, O6, O7	6	“Widespread courses on this topic in university would be effective.” (S1)
Age and Developmental Appropriateness	Age-level based planning, game selection	O1, O3, O4, S2, S6, O5	6	“Planning appropriate for age and development is necessary.” (O3)
Material and Technology Support	Digital tools, quest cards, scoring systems	S11, S12, S13, S15, O11, O12	6	“Digital scoreboards are useful.” (S11) [75]
Activity Variety and Interdisciplinary Approach	Drama, storytelling, trips, active games	S4, S6, O7, O14, O15	5	“Drama and field trips/observation yield successful results.” (O7)

Theme	Sub-Theme	Participants	Frequency	Supporting View
Student Autonomy for Participation	Curiosity, right to choose, child's involvement	S2, O2, O5, O13	4	“Granting children the right to choose makes learning fun.” (O5)
Alignment with Pedagogical Aim	Aiming for meaningful learning, not just fun	S9, O4, O6	3	“Gamification must be compatible with the pedagogical goal.” (S9)
Physical and Equipment Arrangement	Classroom environment, play area, spatial arrangement	S2, O10	2	“There should be play areas in the classroom.” (S2)

Support needed by teachers in the gamification process as depicted in Table 6, have been categorized into seven themes. Within the theme "Teacher Training and Awareness", six participants mentioned that support in the form of practical training, curriculum-included courses, and summer camps is necessary. The participant S1 expressed the idea: "A large number of university courses on this subject would bring a lot of good". Six participants also pointed out the theme "Age and Developmental Appropriateness". The participants highlighted that planning and choosing games suitable for the age should not be overlooked. O3 stated, "Determining content suitable for age is absolutely necessary". By the theme "Material and Technology Support", 6 participants were talking about the need for digital tools, quest cards, and scoring systems. S11 conveyed the opinion, "It is very helpful to have a digital scoreboard". The theme "Activity Variety and Interdisciplinary Approach" was referred to by 5 participants. They suggested that attention should be paid to increasing the use of drama, storytelling, and movement games as well as field trips. O7 indicated, "If drama or going on a field trip/observing, then students get the idea thoroughly". The theme "Student Autonomy for Participation" found support from 4 participants. It was brought forward that the right to choose and students' active involvement in the process are indispensable. O5 stated, "If children are given the right to choose then learning is more enjoyable". Three participants in the "Alignment with Pedagogical Aim" theme argued that gamification should not merely entertain but serve the purpose of meaningful learning. S9 shared the opinion, "Gamification has to be in line with the pedagogical goal". Two participants talked about the "Physical and Equipment Arrangement" theme. They believed that the class setting should be prepared accordingly for gamification activities. S2 asserted, "There should be spaces for games in the classroom".

According to the tables' data, teachers view gamification as a deeply involved method that not only brightens up the students' motivation but also makes the learning process more lasting and efficient. Teachers highlighted the fact that it is through the use of the cleverly designed game elements such as quests, badge systems, and storytelling that they most of all capture students' attention which, consequently, leads to the students' intrinsic motivation and participation increase. This notion was confirmed by both primary school teachers and pre-school teachers, thus, they all spoke one voice. The idea that learning is supported not only cognitively but also emotionally and socially demonstrates the educational strength of gamification. Besides that, variations in teachers' implementation have also been noticed by the different grade levels, where primary school teachers were found to be more willing to use digital systems while pre-school teachers tended to use more concrete and sensory materials. Finally, teachers expressed their willingness to receive different types of support during the gamification implementation. Among the essential support requirements, a practice training, material and technology support, age-appropriate planning, a variety of activities, and the setting up of classroom environments were the major points that teachers highlighted.

Discussion

This qualitative study first presents the participant profile and research context, and then discusses the empirical contribution of comparing pre-school and primary school teachers’ views on gamification, intrinsic motivation, and learning/developmental outcomes. The study has comparatively analyzed the concepts, experiences, and evaluations of gamification of pre-school and primary school teachers, thus unveiling the multidimensional effects of gamification in education. According to the results of the interviews, educators perceive gamification not only as a tool for fun but also as a pedagogical method that brings about cognitive, social, and emotional growth. The teachers interviewed agreed that gamification helped to attract students' attention, thus increasing their participation and making the learning process more productive. Such a statement is consonant with the views of Kapp (2012), and conceptual definitions emphasizing game elements to support engagement in non-

game contexts, and Vázquez-Cano et al. (2023), who maintain that the idea of gamification should be inherently linked to that of meaningful learning. In addition, Türkiye-based evidence highlighting teachers' positive views and the role of concretization/meaningful learning in primary settings supports this interpretation (Arslan et al., 2023; Deringöl & Değirmenci, 2024; Ergül & Erşen, 2023).

The study revealed that teachers' use of various quest cards, badges, leaderboards, and storytelling not only increased motivation but also had a positive effect on students' intrinsic motivation, confidence, and interest in learning. This outcome is in line with the studies of Alenezi (2023), Wahab (2025), and Helvich et al. (2023). Various methods, including the right to choose, success tracking, and visual rewards, were specifically instrumental in enhancing students' intrinsic motivation. One possible reason for this is that these tools serve the psychological needs of autonomy, competence, and relatedness, which are the elements of Determination Theory (Ryan & Deci, 2000), as the core. Importantly, SDT also cautions that controlling, reward-dominant designs may undermine intrinsic motivation (Deci et al., 1999). This warning is relevant because some classroom implementations relying heavily on badges/leaderboards and social comparison have been associated with reduced intrinsic motivation and satisfaction over time (Hanus & Fox, 2015). Therefore, the present findings support a design-sensitive view: teachers tended to report stronger motivational benefits when game elements were connected to learning goals, feedback, and participation rather than functioning as stand-alone rewards. This is consistent with experimental evidence showing that different game elements relate to psychological need satisfaction in different ways (Sailer et al., 2017) and with meta-analytic evidence indicating overall positive effects but notable heterogeneity depending on design and context (Sailer & Homner, 2020).

Analyses of the developmental effects revealed that gamification greatly influenced students' attention span, the growth of their self-confidence, their cooperation, communication skills, and self-regulation. The results of this study are in line with the changes mentioned in the literature of Batlle and González (2023), Rahmawati (2024), and Romero Rodrigo and López Marí (2021). Teaching staff recognized that gamification helps students achieve a deeper learning level by focusing on the development of skills, in particular problem-solving and the making more tangible of the abstract concepts. This "concretization" emphasis echoes Türkiye-based findings in primary education, where teachers and students report that game-based/gamified practices help make abstract content more concrete and support retention (; Deringöl & Değirmenci, 2024; Ergül & Erşen, 2023). Moreover, the study found that social skills like empathy, sharing, and taking responsibility were being developed, which is consistent with the trend of preschool teachers who more and more incorporate sensory, dramatic, and character-based approaches. These perceived socio-emotional benefits are also compatible with evidence syntheses indicating that gamified interventions can be linked to psychosocial well-being and socio-emotional outcomes, although effects vary by implementation (Kubota et al., 2024).

Sensory and dramatization games largely have been found to be efficacious in the early childhood period, while primary school-level digital and storytelling-based approaches have demonstrated effectiveness. The difference here is in line with the 'developmental appropriateness' principle that the authors refer to in their works, Xu and Sukavatee (2025) and Mårell-Olsson (2022). Moreover, the research uncovers the differing preferences of pre-school and primary school teachers for gamification strategies that target different age groups. In other words, pre-school teachers strongly recommend movement, role-playing, and imitation-based games, whereas primary school teachers focus more on task-based systems, scoring, leaderboards, and digital content. This pattern is consistent with the "play-first" and guided-play perspective in early childhood education, which emphasizes developmentally appropriate learning through playful exploration supported by adult scaffolding (Weisberg et al., 2013), and with systematic review findings that stress context- and age-sensitivity in gamification outcomes (Dehghanzadeh et al., 2023; Zeybek & Saygı, 2024). In addition, meta-analytic evidence suggests that gamification can have positive cognitive and motivational effects overall, but design moderators (e.g., narrative/game fiction, social interaction, and the balance of competition/collaboration) shape outcomes (Sailer & Homner, 2020). Accordingly, the present study contributes by directly comparing two adjacent educational levels and showing how teachers translate "developmental appropriateness" into different gamification toolkits (sensory/drama in pre-school vs. more structured/digital elements in primary school).

Teachers have indicated their needs for backing in such areas as technological infrastructure, supply of materials, curriculum alignment, time, and teacher training for the efficient use of gamification. Nevertheless, it was emphasized that issues thrown up by the implementation, e.g., technical malfunctions, lack of time, and

shortage of materials, can not only obstruct the process but also put a negative influence on it. These discoveries correspond to the work of Vázquez-Cano et al. (2023) and Romero Rodrigo and López Marí (2021) that deal with the recognition of systemic barriers. They also reinforce the implication that effective gamification requires teacher professional development not only in “tools” but also in pedagogical design principles (e.g., aligning game elements with learning goals and supporting autonomy/competence/relatedness) (Ryan & Deci, 2000; Deci et al., 1999).

The outcomes of this study align with those in the research of Wahab (2025) that concerned primary school students where gamification had a bright impact on participation and achievement, notably in abstract and hard subjects like mathematics. Similarly, Rahmawati (2024) demonstrated that gamification is a powerful instrument that can be used to raise the social skills of children, e.g., empathy, sharing, and responsibility. The situation agrees with the fact that pre-school teachers mostly employ sensory, dramatic, and character-based methods.

Looyestyn et al. (2017) and Koivisto and Hamari (2019) claimed that the process of gamification fosters the engagement of students, their social interaction, and the development of their self-regulation skills. Not only has this study confirmed such an effect, but it has also noted that students' self-confidence, attention spans, and learning motivation have been particularly strengthened. The teachers involved in the research pointed out that students were most motivated by the activities in which they could choose themselves and that students demonstrated a higher level of engagement in those activities. As a result, gamification turning into a means of self-directed learning is strongly suggested by this fact.

The research findings reveal gamification as a multi-faceted tool for students' intrinsic motivation and their cognitive-emotional development. Specifically, it was corroborated by teachers' opinions that game elements arranged in a coherent way such as quest cards, badge systems, and storytelling characters stimulate learner's autonomy. Similarly, Kuo et al. (2016) also claimed that gamification is a means of student engagement and learning retention. The teachers of this study also reported the intrinsic motivation growth by such sayings as, "They do not want to leave the classroom without completing the task". This type of statement is consistent with the idea that well-designed gamification can support persistence and engagement, yet the literature also emphasizes that outcomes depend on design choices and learning context (Koivisto & Hamari, 2019; Sailer & Homner, 2020).

Besides that, the current study shows that teachers from the pre-school and primary school sectors differently utilize various tools to gamify their teaching based on the children's age. While Domínguez et al. (2013) propose the age-wise differentiation of digital and concrete game materials, the teachers in this research felt that digital devices are more effective at the primary school level, whereas sensory materials are more engaging at the pre-school level. The findings with regard to social and emotional development through gamification reveal that, in addition to the academic, the method also brings socio-psychological benefits. This finding is also aligned with the research by Hamari et al. (2014); it is argued that gamification opens up new social participation opportunities thus learners' self-confidence is strengthened. In Türkiye, early-childhood evidence also indicates that digital tools can increase participation and provide engagement affordances, but may introduce pedagogical and equity concerns if technology dominates hands-on, social learning (Başalev-Acar & Bedel, 2024). This nuance complements teachers’ accounts by highlighting why “developmental appropriateness” and teacher guidance are central in pre-school gamification.

Summing up, the findings indicate that gamification provides students with new social, emotional, and cognitive developmental spheres besides the academic ones. The study highlights that the opinion of teachers about implementing an application depends on the students' age, educational goals, and the current situation, but, nevertheless, gamification is quite potent when it is developmentally appropriate and thoughtfully arranged. So, in turn, it is proposed to embed gamification performance into teacher training modules, uplift the level of professional development programs, and produce game-based digital resources that are in harmony with pedagogy. Besides that, it is important to differentiate gamification uses by age and developmental stage in order to offer personalized learning experiences. Also, as per the synthesis of the thematic integrity, the definitions, applications, and support needs for both primary and pre-school teachers regarding gamification mostly reveal that they have a lot in common, but also differ in certain aspects based on the age group. Educators reported that the utilization of the badge system, quest cards, drama, and storytelling automatically energizes and supports learners in recalling what they have learned. Overall, the study is positioned in the literature as a comparative, context-specific contribution that responds to calls for more theory-informed and design-sensitive K–12 gamification research (Dehghanzadeh et al., 2023; Zeybek & Saygı, 2024).

There is a point to be made that while elementary teachers are more digital-oriented, preschool teachers tend to be more concrete-materials-oriented. The participants also share the belief that gamification exercises will be successful if they bring pedagogical benefits and correspond to the age and developmental level of the students. These discoveries imply that gamification should not be simply a means to make learning enjoyable but rather a significant, intentional, and student-centered learning method that is aligned with learning goals and supports learners' psychological needs (Deci et al., 1999; Ryan & Deci, 2000).

Based on the results and the rationale provided in the previous sections, the below recommendations are directed to education policymakers, teachers, and researchers:

- Developmentally Compatible Content Strategy: The content of the gamification applications should be designed as a modular and flexible repository that is well adapted to different age groups. The repository has to be a first priority for the concrete, sensory, and autonomy-focused applications of the pre-school while the task-based, digitally-enhanced, and storytelling-focused applications for the primary school should be the second.
- Technological and Infrastructural Support: In order for the gamification of digital platforms to be effectively used in schools the necessary technical infrastructure, hardware, and software support need to be provided. Also, the efforts to establish central support systems that will alleviate digital disparities in the remote areas should be intensified and broadened.
- Promoting Student Autonomy and Choice: It is very important that students are allowed to make a choice during the gamification process, since it enlarges their intrinsic motivation and supports their active engagement. Hence, teachers must continually provide game structures and scenarios where flexibility and alternatives for students' autonomy are available.
- Applied and Integrated Teacher Training: There is a need to organize experiential workshops during teacher training which would be focusing more on practical skills like the creation of quest cards, the use of digital leaderboards, and gamification-related storytelling. Not only should these games be part of both in-service and pre-service training programs, but also training should be designed in such a manner that it is sensitive to different age groups.
- Strategic and Pedagogical Alignment: A critical point in gamification to be considered is the fact that the respective applications should not be planned randomly but in a way that the learning objectives are integrated. Educators ought to position the use of gamification beyond that of a mere motivation-boosting instrument by evaluating it as a strategic teaching method that can bring pedagogical benefits.
- Mixed-Methods and Longitudinal Research: The present work was conducted using qualitative data sets, but the authors also point to the necessity of mixed-methods research to bring further clarity to the effects of gamification on academic achievement, social skills, and self-regulation. The research findings also call for future monitoring studies that would focus on the longitudinal outcomes of the intervention.
- Curriculum Integration and Professional Support: Teachers require assistance with pedagogical design knowledge, planning of lessons with game elements, and technology use. The theories and applications of gamification should be incorporated into the teacher training curriculum, and the main focus should be on the development of the material through a collaborative interdisciplinary approach.

Conclusion

Findings from the current research reveal that most educators warmly welcome gamification as an effective instructional method. Based on their reports, this method helps student engagement, intrinsic motivation, and social-emotional development in the educational process. However, the positive effect continuation is a kind of condition that depends on the differentiation of uses according to the developmental features of different age groups and the provision of enough technical and pedagogical support to the teachers. Hence, the problem of overcoming infrastructural shortcomings is very significant, firstly, because of the increased demand for digital applications in the primary school level.

Author's Note

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Credit Authorship Contribution Statement

Conceptualization: M.Ş., S.E.; Methodology: M.Ş., S.E.; Investigation: M.Ş., S.E.; Data curation: M.Ş., S.E.; Formal analysis: M.Ş., S.E.; Validation: M.Ş., S.E.; Writing – original draft: M.Ş., S.E.; Writing – review & editing: M.Ş., S.E.; Supervision: M.Ş., S.E.

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Declaration of AI Usage Statement

The authors declare that no artificial intelligence (AI) tools were used in the conception, data collection, analysis, interpretation, or writing of this manuscript.

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|Research Article / Araştırma Makalesi|

An Examination of Middle School Students' Digital Game Addiction and School Engagement Levels Based on the Variable of Participation in School Sports

Ortaokul Öğrencilerinin Dijital Oyun Bağımlılığı ve Okula Bağlılık Düzeylerinin Okul Sporlarına Katılım Değişkeni Bakımından İncelenmesi

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Keywords

Digital game addiction

School engagement

School sports

Abstract

The purpose of this study is to examine the levels of digital game addiction and school engagement of middle school students in terms of participation in school sports. The descriptive survey model was used in the study. The population consisted of middle school students aged 10–14 studying in the city center of Kastamonu province during the 2024–2025 academic year. Due to the difficulty of reaching the entire population, purposive and convenience sampling methods were used together. Data were collected using the Personal Information Form, the Digital Game Addiction Scale for Children (DGAC) developed by Hazar and Hazar (2017), and the School Engagement Scale (SES) developed by Fredricks et al. (2005) and adapted into Turkish by Çengel et al. (2017). The data were analyzed using SPSS 26.0 software. The findings revealed that students participating in school sports scored significantly lower on all subdimensions of the DGAC compared to those who did not participate. In contrast, non-participating students demonstrated higher levels of school engagement compared to student-athletes. Regarding gender, female students scored lower than male students in digital game addiction, while differences in school engagement were limited to certain subdimensions. In terms of grade level, 8th-grade students had the lowest mean scores on both scales. Furthermore, a positive and statistically significant relationship was found between all subdimensions of school engagement and digital game addiction. These findings suggest that sports participation may reduce time spent on digital games by promoting healthier and more structured use of leisure time. It can be suggested that the gains provided by sport play a regulatory role in students' gaming behavior. However, in terms of school engagement, it was determined that students who did not participate in school sports had significantly higher levels of engagement. This situation may be explained by the possibility that the athletic identity of student-athletes takes precedence over their student identity.

Anahtar Sözcükler

Dijital oyun bağımlılığı

Okula bağlılık

Okul sporları

Öz

Bu çalışmanın amacı, ortaokul öğrencilerinin dijital oyun bağımlılığı ve okul bağlılığı düzeylerini, okul sporlarına katılım değişkeni açısından incelemektir. Araştırmada betimsel tarama modeli kullanılmıştır. Araştırmanın evrenini, 2024–2025 eğitim-öğretim yılında Kastamonu il merkezinde öğrenim gören 10–14 yaş arası ortaokul öğrencileri oluşturmaktadır. Evrenin tamamına ulaşmanın güç olması nedeniyle amaçlı örnekleme ve kolayda örnekleme yöntemleri birlikte kullanılmıştır. Veri toplama aracı olarak Kişisel Bilgi Formu, Hazar ve Hazar (2017) tarafından geliştirilen Çocuklar İçin Dijital Oyun Bağımlılığı Ölçeği (DGAC) ile Fredricks vd. (2005) tarafından geliştirilen ve Çengel vd. (2017) tarafından Türkçeye uyarlanan Okul Bağlılığı Ölçeği (SES) kullanılmıştır. Veriler SPSS 26.0 programı ile analiz edilmiştir. Araştırma bulguları, okul sporlarına katılan öğrencilerin Dijital Oyun Bağımlılığı Ölçeği'nin tüm alt boyutlarında, katılmayan öğrencilere göre anlamlı düzeyde daha düşük puanlar aldığını göstermiştir. Buna karşılık, okul sporlarına katılmayan öğrencilerin okul bağlılığı düzeylerinin, spor yapan öğrencilere göre daha yüksek olduğu belirlenmiştir. Cinsiyet değişkenine göre yapılan analizlerde, kız öğrencilerin dijital oyun bağımlılığı düzeylerinin erkek öğrencilere göre daha düşük olduğu; okul bağlılığı açısından ise farklılıkların yalnızca bazı alt boyutlarla sınırlı olduğu ortaya konmuştur. Sınıf düzeyine göre yapılan değerlendirmelerde ise 8. sınıf öğrencilerinin her iki ölçekte de en düşük ortalama puanlara sahip olduğu tespit edilmiştir. Ayrıca, okul bağlılığının tüm alt boyutları ile dijital oyun bağımlılığı arasında pozitif ve istatistiksel olarak anlamlı ilişkiler bulunmuştur. Bu bulgular, spor etkinliklerinin öğrencilerin boş zamanlarını daha sağlıklı ve yapılandırılmış bir şekilde değerlendirmelerine olanak tanıyarak dijital oyunlara ayrılan süreyi azaltabileceğini göstermektedir. Bu bağlamda, sporun öğrenci davranışlarını düzenleyici bir rol üstlenebileceği söylenebilir. Bununla birlikte, okul bağlılığı açısından değerlendirildiğinde, okul sporlarına katılmayan öğrencilerin bağlılık düzeylerinin spor yapan öğrencilere göre anlamlı düzeyde daha yüksek olduğu belirlenmiştir. Bu durumun, öğrenci sporcuların sporcu kimliklerinin öğrenci kimliklerinin önüne geçmesiyle ilişkili olabileceği düşünülmektedir.

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Introduction

Notable alterations have been detected in children's engagement in physical activities and sports in recent years. In the past, children met their physical activity needs through unstructured outdoor play, while today, this need is increasingly met through organized and structured activities, courses, or club-based programs under professional supervision (Gray, 2011). It might be claimed that parental protective attitudes, worries about safety that come with living in a city, and the change from conventional play modes to digital platforms have all had a role in this change. Empirical research supports this view, indicating that parental safety concerns significantly restrict children's independent outdoor play, while increased engagement with digital media is associated with reduced physical activity levels (Valentine & McKendrick, 1997; Tremblay et al., 2011).

These days, kids meet their fitness and sports needs more often in supervised and regulated environments than by playing outside like they used to (Dapp et al., 2021). In this instance, school sports are very important since they give kids a safe, easy, and pleasant way to do exercise. Students can play sports at school with their friends, and professors or coaches will be watching over them. Most of the time, it's free. This fulfills a fundamental requirement for physical development and social engagement. Trudeau and Shephard (2008) asserted that heightened participation in school-based physical activities correlates with a substantial enhancement in overall physical fitness. Öcal and Koçak (2010) found in their study that kids who played sports at school were better at socializing, being responsible, controlling their emotions, and learning about other cultures than kids who didn't play sports. In this context, it may be said that schools significantly enhance children's social, emotional, and cultural development by providing organized conditions for physical activity (Singh et al., 2012). We need to look at both physical education classes and sports activities outside of school at the same time to get a comprehensive picture of how school sports work.

Physical Education Classes and Extracurricular Sports Activities Conducted in Schools

The improvement of physical education in Türkiye means that the government is changing its perspective on young people and public health. When the Republic of Türkiye was established and the concept of physical education was introduced the process that had begun in the late Ottoman period with military discipline and strength-based gymnastics routines became essential in schools and gained further importance during the Atatürk era as it was believed that sport contributed to children's physical, cognitive, and moral development (Günay, 2013). Physical education curricula have evolved from a militaristic focus on discipline to a more comprehensive educational framework and since the 2000s they have been restructured to develop not only psychomotor skills but also cognitive awareness, healthy living habits, and values (Özçakır, 2015)

In Türkiye, physical education is implemented as a compulsory subject in middle school as an integral part of the formal education system. The Physical Education, Games, and Sports Curriculum developed within the framework of the Türkiye Century Education Model integrates students' basic motor skills, rhythmic movements, and the culture of games and sports while promoting positive attitudes toward physical activity, encouraging active lifestyles, enhancing social-emotional competencies, and supporting participation in elective and extracurricular sports aligned with students' interests and abilities (Ministry of National Education, 2025). Students might choose to take elective classes that focus on subjects that interest them and those they are good at. This paradigm promotes autonomous student engagement in sports, enhancing their intrinsic motivation (Aydın et al., 2022). School sports are not the same as other activities outside of school.

Physical education used to be only about how well you did in sports, but now it's a branch of study that encompasses many other things. The Türkiye Century Education Model, which started in 2024, has made this change clearer and more organized. The idea is centered on the student and has a broad and open-minded view of education. According to the Ministry of National Education (2025), physical education is not only a means of promoting physical activity but also a strategic field that supports students' social, emotional, cultural, and cognitive development, emphasizing an inclusive and student-centered approach in contrast to the traditional system in which children were generally regarded as passive participants. The Türkiye Century

Education Model aims to ensure the inclusion of all children by addressing their individual needs, making physical education sessions more accessible, diversifying learning environments for different physical ability levels, encouraging boys and girls to participate in sports together, and increasing accessibility for children with special needs (Nakip, 2024)

The Historical Development of School Sports and Their Current Status in the Curriculum

In Türkiye during the early Republican period, schools emphasized physical education based on the premise that sports may help kids grow physically, cognitively, and morally (Pehlivan, 2004). Today, this historical route has become an institutional framework since the Ministry of National Education and the Ministry of Youth and Sports worked together. School sports activities are conducted under the coordination of the General Directorate of Sports Services of the Ministry of Youth and Sports, and a national competition calendar is announced at the beginning of each academic year (Ministry of Youth and Sports, 2025a).

In Türkiye, school sports activities are conducted under the coordination of the General Directorate of Sports Services of the Ministry of Youth and Sports, and sports branches and age categories are officially determined for each academic year. When examining the "Sports Branch, Age, and Category Table" published for the 2025–2026 academic year, it is observed that school sports have a multi-branch and tiered structure. Accordingly, the activities include a wide range of individual and team sports such as athletics, basketball, volleyball, football, handball, badminton, table tennis, judo, wrestling, tennis, swimming, hockey, archery, karate, taekwondo, modern pentathlon, folk dances, and similar sports. Students are categorized according to their ages. At the middle school level, kids compete in sports based on their birth year and the sport they play. This strategy makes sure that kids compete in conditions that are good for their growth and development and lets sports activities happen based on teaching methods. Also, the fact that some sports have divisions for impaired athletes shows that school sports are meant to include everyone (Ministry of Youth and Sports, 2025b).

This institutional framework shows that school sports are more than just competitions; they also offer a systematic, step-by-step, and curriculum-integrated sports model (Fakazlı & İlhan, 2023). Sports teams in school help pupils put what they learn in class into practice in the real world. For instance, they educate kids how to be responsible, work together, make plans, and obey regulations in a real-world context (Bailey, 2006). From this point of view, school sports may be seen as a way to improve the performance, social learning, and values education parts of physical education within the current educational system (Pehlivan, 1998; Tan, 2021; Turan, 2020).

The Educational Function and Theoretical Positioning of School Sports

School athletics are more than just a way to get some exercise. They represent a systematic, learning-oriented approach that provides students with structured practice opportunities in schools, supports multidimensional learning outcomes, and is examined in international literature across various subcategories such as physical education classes, school teams, club activities, and extracurricular sports events (Bailey, 2006; Trudeau & Shephard, 2008). In this context, physical education and sports classes are integrated as either compulsory or elective components of the formal curriculum, whereas school teams and extracurricular sports activities are regarded as voluntary endeavors, characterized by either a performance-oriented or recreational focus (Marsh & Kleitman, 2002). The literature delineates this structure via formal and informal modalities of sports participation (Coalter, 2013). The formal dimension encompasses in-class activities integrated into the curriculum, characterized by distinct pedagogical objectives and established assessment protocols. In contrast, the informal dimension comprises sports organizations linked to school identity and social belonging, in which students participate voluntarily (Eccles & Barber, 1999). As all sports organizations were cancelled during the Covid-19 pandemic (Seçer et al., 2025), school sports activities in Türkiye were also suspended following the official directive on the cancellation of social activities issued in March 2020 and were later reintroduced with the implementation principles published for the 2021–2022 academic year (Ministry of National Education, 2020; Ministry of Youth and Sports, 2021).

In Türkiye, the Ministry of National Education mandates compulsory physical education and sports courses within the formal curriculum across primary and lower secondary education levels through the Physical Education, Games, and Sports Curriculum, aiming to develop students' motor competence, physical

fitness, knowledge of active and healthy living, and social-emotional skills, while also supporting participation in school teams, tournaments, and club activities through extracurricular sports programs (Ministry of National Education, 2025). In this context, competition-based organizations, referred to as extracurricular sports activities coordinated by the Ministry of National Education and the Ministry of Youth and Sports, are carried out under the name of school sports activities. These informal activities complement the formal curriculum and provide social spaces that support students' integration with school identity. Formal physical education classes carry out this process with systematic teaching strategies, while extracurricular sports activities provide opportunities for experiencing and reinforcing performance in a real game context. In this context, in secondary education in Türkiye, formal and informal programs in physical education and sports stand out as two complementary pedagogical areas, as the formal structure involves rule-based and institutionalized practices, whereas informal sports activities provide a more flexible and participant-oriented learning environment that complements this structure (Yalçın, 2021).

When national and international studies examining the relationship between school sports and school attachment/belonging are evaluated together, it is observed that sports participation has significant and mostly positive effects on the psychosocial bonds that students establish with their school. Quantitative studies conducted in the context of Türkiye have shown that students who participate in school sports teams have higher levels of school belonging and commitment compared to their peers who do not engage in sports (Kangalgil et al., 2024; Serbest et al., 2025). Similarly, it has been reported that extracurricular sports activities conducted in secondary education increase students' levels of school commitment and strengthen their sense of belonging (Yılmaz, 2019; Yanık, 2018). Positive relationships between school climate, school life quality, and school attachment at the middle school level also indicate the supportive role of sports and social activities in enhancing the school experience (Dönmez & Taylı, 2018). However, some studies indicate that sports participation has an impact through indirect variables; for example, as technology addiction increases, school attachment decreases, and sports can play a balancing role in this process (Arslan et al., 2023). The worldwide research indicates that the student-athlete identity influences the relationship between academic and athletic obligations; these responsibilities may be perceived as harmonious in certain instances and as conflicting in others (O'Neil et al., 2021). The evidence suggests that organized school sports activities help children cultivate good attitudes towards school, mitigate emotions of rejection, and enhance their sense of worth within the educational setting. However, it is noted that the effect might differ based on contextual circumstances (such as school type, gender, grade level, financial level, etc.) and that sports provide more significant outcomes when assessed in conjunction with school environment and social support systems.

Many people think that school sports are an important part of both the educational and athletic systems (Marković et al., 2024). The main goal of school sports is to support students' physical, mental, and social development while promoting cooperation, respect for rules, and universal values such as justice, tolerance, and helpfulness, as well as raising awareness of the importance of sport for individuals, society, and the environment (Pehlivan, 2004). In this context, school sports are considered an intermediary structure that has both pedagogical and developmental functions, positioned in the interaction area between formal education and school culture (Bailey, 2006).

The literature shows that the middle school period (early adolescence) is a critical developmental stage in terms of psycho-social and academic adjustment; structured sports participation during this period can play a protective role in fostering a sense of belonging, self-regulation skills, and school attachment (Eccles & Barber, 1999; Fredricks & Eccles, 2006). It is stated that participation in extracurricular sports activities, in particular, contributes to students developing a stronger identification with the school climate and increasing their academic motivation (Farb & Matjasko, 2012). In this regard, it is suggested that school sports are not only related to physical health outcomes but also to behavioral, affective, and cognitive dimensions of school engagement (Fredricks et al., 2004).

School Engagement: Theoretical Foundation and Its Relationship with School Sports

School engagement is a multidimensional construct that explains a student's participation in school life and the psychological bond they form with the school (Jimerson, et al., 2003). In this sense, School attachment is a broad idea that includes a lot of things that can change how students feel about their schools (Libbey, 2004). School attachment refers to the bond students develop with various aspects of school and

academic life during the learning process and is largely shaped by the extent to which they align with the goals and achievements of the school (Maddox & Prinz, 2003). Audas and Willms (2001) define school attachment as students' participation in academic or extracurricular activities and their congruence with the institution's values and goals. Fredricks et al. (2004) contend that school attachment consists of three fundamental components: behavioral, emotional, and cognitive. Students who are behaviorally engaged are doing both schoolwork and things with friends. Students who participate in extracurricular activities such as sports tend to show higher academic achievement and stronger school engagement, which is conceptualized as a multidimensional construct encompassing emotional, behavioral, and cognitive dimensions, including students' feelings toward school, participation in school-related activities, and their intrinsic motivation and mental effort in the learning process (Jimerson et al., 2003; Can et al., 2025).

When looking at the behavioral aspect of school attendance, it is very important for students to participate not only in academic and social activities but also in a wide range of extracurricular activities (Arslan et al., 2023). People generally think that participating in extracurricular activities shows that you are interested in school (Fredricks et al., 2004). At this point, school sports stand out as an important structural element that strengthens the social and emotional bonds a student forms with the school environment (Eccles & Barber, 1999; Marsh & Kleitman, 2002). The types of extracurricular activities students participate in and how often they engage in them are important indicators of their level of involvement in school (Jimerson et al., 2003). It has been reported that students who participate in school sports develop a stronger identification with school identity and have a higher level of adherence to school rules (Mahoney et al., 2003). This situation shows that sports are not just a physical activity; they are a means of social integration and integration with school culture. In this sense, it can be said that there is a relationship between school sports and school attendance. The literature contains studies investigating the correlation between participation in school sports and levels of school attachment (Öğredik, 2024; Yanık, 2018; Yılmaz, 2019). Beyond these contexts, digital games, an increasingly complex ecosystem that attracts individuals of all ages, emerge as another significant variable.

The Relationship Between Digital Games and Addiction

Digital games are games produced, presented, and played through digital technology. Generally speaking, they can be considered works of art, design, technology, and research (Bleumers et al., 2012). Frasca (2001) defined digital games as leisure activity software that allows individual or multiple participants to engage with the game devices, either alone or interactively, through an online network, installed on the devices. Similarly, Kerr (2006) defines digital games as games played within a specific set of rules and goals, through various digital devices (e.g., mobile phone, tablet, game console, etc.). Recent technological advancements have greatly affected the quick spread of digital games. The fact that computers, tablets, smartphones, and game consoles are all easy to get to has made the switch from traditional to digital gaming even faster. Digital games have become a useful tool for helping kids grow not only in their motor skills but also in their social and cognitive skills. Furthermore, it may be asserted that digital games may significantly influence other facets of children's lives, including their academic performance and degree of school participation. Doğan (2016) points out that many traditional games where kids used to play outside with friends have been slowly replaced by digital games. This is due to advancements in information and communication technology, as increased technology use has been found to be significantly associated with lower levels of physical activity among children (Alotaibi et al., 2020). Digital and traditional games have a lot in common in terms of how they work and what they mean. The distinguishing factors include the type of games played, the number of players, the tools and equipment used, the game's content, and the formal differences (Hazar et al., 2007).

Children who are more engaged with new technologies tend to show greater interest in digital games, whose interactive and emotionally engaging features can contribute to prolonged use and the development of game addiction (Yalçın-Irmak & Erdoğan, 2016). Children may sacrifice sleep, nutrition, and real-life social interactions to spend more time in the virtual environment, where the constantly evolving nature of digital games and the desire to achieve successive goals can transform the intention of "just a few more minutes" into prolonged periods of play (Sherry et al., 2006). This situation gave rise to the notion of digital gaming addiction in academic literature. People who are addicted can't stop doing or using something, and they can't

live without it. In this case, the person keeps doing or using something even though they don't want to. Over time, this makes it harder for the person to do their daily tasks, keep up with their social life, and meet their obligations. Furthermore, addiction can result in a decline in functionality across various aspects of life, as a substantial amount of an individual's time and physical energy becomes focused on the substance or behavior in question (Kodaman & Dinç, 2016). Digital game addiction is considered a subtype of technology and internet addiction and is classified as a behavioral addiction characterized by compulsive and excessive use, loss of control, and repetitive gaming behaviors (Lemmens et al., 2009).

Factors such as prolonged gaming time, preferred game types, and lack of parental supervision increase the risk of negative outcomes associated with digital gaming, while digital game addiction is linked to various health problems, including eating disorders and sleep disturbances due to prolonged inactivity (Otsuka et al., 2021). It is observed that various negative outcomes, such as aggressive behavior, social isolation, and addiction, are also frequently examined, particularly in connection with the harmful aspects of violent digital games (Ferguson, 2007). Gentile et al. (2011) conducted a study investigating the correlations between digital game addiction, depression, and academic achievement in children and adolescents. Research findings indicate that individuals with gaming addiction exhibit various psychosocial problems, including depression, anxiety, and social difficulties, along with lower academic performance, although the specific patterns of these outcomes may vary across studies (Gentile et al., 2011; Lemmens et al., 2011; Mihara & Higuchi, 2017). Additionally, it is stated that digital games can lead to a blurring of the boundaries between reality and imagination in individuals, a decrease in emotions and feelings, and consequently, negative changes in interpersonal relationships (Mehroof & Griffiths, 2010).

Children who grew up immersed in technology and continued their development through digital tools can be considered the most effective users of technology and the generation with the highest level of technological literacy (Novrialdy et al., 2019). In this context, it can be stated that it is not possible to keep the new generation completely away from technology. Because technology is considered one of the fundamental elements that is present in almost every aspect of modern life and makes daily life easier. In this regard, it can be asserted that it is difficult to completely remove digital games from children's lives. However, it can also be said that if these games are played in a moderate, controlled, and conscious manner, they can continue their educational or entertaining functions without posing a risk of addiction, and this will not lead to any negative consequences. Yalçın-Irmak and Erdoğan (2016) stated that educational, informative, and constructive digital games, when played within controlled and reasonable time limits, can be a supportive tool for the development of children and adolescents. Pepe (2011) stated that digital games have a positive impact, especially on an individual's mental development. The impact of digital games on children, both beneficial and detrimental, is significantly influenced by the manner, duration, and substance of their engagement with these games.

Upon reviewing the literature, it is evident that the correlation between digital game addiction and physical activity and sports engagement at the middle school level was mostly been investigated via quantitative and relational survey methodologies. In the study conducted by Hazar et al. (2017), a negative and significant relationship was found between middle school students' digital game addiction and their levels of physical activity; it was determined that as physical activity increased, the scores of digital game addiction decreased. In the study published in Spormetre, it was reported that the levels of digital game addiction among middle school students significantly varied, particularly according to gender, age, and daily game duration; the level of addiction increased in male students and as the game duration increased (Hazar et al., 2020). In the study conducted on students participating in the summer sports school, it was found that attitudes toward playing digital games showed significant differences based on gender and daily gaming duration; however, the duration of sports practice alone was not determined to be a decisive variable (Yazıcıoğlu et al., 2021). Therefore, the existing literature suggests that school-based sports participation may potentially have a reducing effect on digital game addiction, but this relationship should be evaluated within the framework of multidimensional variables.

Purpose, Importance, and Problem Statement of the Research

When the current literature is carefully examined, it is observed that studies either address digital game addiction and physical activity, digital game behaviors and sports participation, or school sports and

school attachment at the level of binary variables. However, there appears to be no research that simultaneously examines the variables of school sports participation, digital game addiction, and school attachment among middle school students. However, during the basic education period, both the student's inclination toward digital environments and the emotional bond they establish with the school are shaped within the same developmental process. The examination of these three variables together is considered quite important in terms of holistically revealing the potential of sports to support not only physical but also behavioral regulation and school attachment. In terms of educational literature, this approach offers the opportunity to fill an interdisciplinary gap by testing the potential protective role of sports against digital addiction and its function on school attachment within the same model. Especially in the context of primary education, this holistic analysis can significantly contribute to the development of policies and programs aimed at practice, in terms of both fostering healthy lifestyle habits and cultivating positive attitudes toward school among students.

The middle school years are a very important period for students to develop their digital habits and emotional connections to school (Fredricks et al., 2004). Increases in digital gaming, changes in physical activity levels, and participation in school sports can directly influence students' academic and social adjustment (Bailey, 2006; Fredricks et al., 2004; Gentile et al., 2011); however, existing research has predominantly examined these variables through isolated or pairwise relationships, such as the effects of physical activity on health outcomes (Janssen & LeBlanc, 2010) or the role of social support in school engagement (Wang & Eccles, 2012), and studies that simultaneously integrate school sports participation, digital game addiction, and school connection within a comprehensive model remain limited.Therefore, the simultaneous analysis of these characteristics is crucial for developing pedagogical techniques in primary education and for designing school-based intervention programs. In this respect, the study seeks to examine the degrees of digital game addiction and school engagement among middle school students in relation to their participation in school sports. From this point of view, the main research question of the study is stated as follows: What is the relationship between middle school students' participation in school sports, their levels of digital game addiction, and their commitment to school? The sub-research inquiries are as follows;

1. Do middle school students' digital game addiction scores show significant differences by gender?
2. Do middle school students' school engagement scores show significant differences by gender?
3. Do digital game addiction scores show significant differences based on participation in school sports?
4. Do school engagement scores show significant differences based on participation in school sports?
5. Do digital game addiction and school engagement scores show significant differences according to grade level?
6. Is there a significant relationship between digital game addiction and school engagement?

Method

Research Design

This study utilized a quantitative research methodology to investigate the prevalence of digital game addiction and school attachment among middle school students, specifically in relation to their participation in school sports. The study employed a descriptive survey model to elucidate the current situation and identify the differences among the variables.

The descriptive survey model, which falls under quantitative research, aims to present the current situation using quantitative data (Creswell, 2014). In this sense, it can be defined as a research design that allows for the description of the views, attitudes, behaviors, or characteristics of individuals located in a specific universe (Karasar, 2006). In the current study, in line with this research model, it was aimed to measure the digital game addiction and school attachment levels of students, and to examine whether these two variables showed a significant difference based on their participation in school sports.

The independent variable of the study is the students' participation status in school sports (participant–non-participant), and the dependent variables are the level of digital game addiction and the

level of school attachment. Since the study aimed to analyze the current situation, no intervention or experimental application was carried out.

Study Group

The participants of this investigation include all middle school students aged 10-14 enrolled in the center of Kastamonu province for the 2024-2025 academic year. Because it is hard to look at the whole universe, the study used both purposive sampling and convenience sampling as the sampling method. Time and accessibility were taken into account when choosing participants using the convenience sampling method (Büyüköztürk et al., 2023), while the following criteria were used to get more detailed information using the purposive sampling method (Patton, 2015).

The criteria for inclusion in the study are as follows: (i) being in the age range of 10–14, (ii) being an active student in the relevant schools during the 2024–2025 academic year, and (iii) having submitted a parental consent form. Forms with incomplete data and students without voluntary participation consent were excluded from the research scope. In this context, three state middle schools in the center of Kastamonu, which show different socio-economic characteristics and physical conditions, were included in the scope of the research. In the selection of the schools, both the regular conduct of school sports activities and the potential variation in students' access to digital games were taken into consideration.

In the selection of schools, their location in different neighborhoods and the diversity in student profiles were taken into account. No official institutional data regarding the socio-economic level was used; it was anticipated that student profiles might differ based on the environmental characteristics of the schools and discussions with school administrations. Differences in physical conditions were determined based on criteria such as the presence or absence of a gymnasium, the capacity of the school's outdoor sports facilities, the number of weekly sports activities, and the number of active sports teams at the school. The criterion of "regularly conducting school sports activities" is defined as the school's participation in official competitions at the provincial/district level in at least two different sports (for example, football, volleyball, basketball, athletics) and the regular implementation of weekly training programs.

Participants were reached through in-person field visits conducted in coordination with school administrations following the necessary institutional permissions. The level of students' access to digital games was determined through short preliminary questions posed before the data collection process. In this context, students were asked about their daily digital gaming duration, weekly gaming frequency, which platform(s) they use to play games (mobile, computer, console, etc.), and whether they play online games. These questions were used to evaluate the intensity of students' access to the digital gaming environment and the continuity of their usage through behavior-based indicators. Demographic information about the research group is presented in Table 1.

Table 1

Demographic Characteristics of the Study Group

Variable	Group	N	%
Gender	Female	192	46,2
	Male	224	53,9
	Total	416	100,0
Grade Level	5th Grade	108	26,0
	6th Grade	72	17,3
	7th Grade	106	25,5
	8th Grade	130	31,3
	Total	416	100,0
Participation in School Sports	Participated	174	41,8
	Did not participated	242	58,2
	Total	416	100,0

Data Collection Tools

When it came to the process of gathering information for the research project, a form consisting of three sections was applied. The participants' personal information was collected through the use of a personal information form, which was located in the first half of the form. In the second part of the study, scales were utilized to determine the extent of addiction to interactive video games. In the third and final segment, various scales were utilized in order to ascertain the degree of connection that each participant had with their respective educational institution. Information regarding the scales and personal information form is presented in this section.

Information Form for Personal Use: The researcher developed a form that was used to collect personal information. Concerning this particular case, the form contains three questions related to gender, grade level, and involvement in school athletics.

Digital Game Addiction Scale for Children: This study utilized the DGAC created by Hazar and Hazar in 2017, to assess the digital game addiction levels among the participants. The developed scale is a measurement tool developed to determine children's levels of addiction to digital games, and its validity DGAC and reliability was proven. The scale was developed using a 5-point Likert-type rating model. The scale consists of 24 items with four sub-dimensions.

The internal consistency coefficient for the total scale, calculated using Cronbach's alpha, was found to be high. The reliability coefficients for the subdimensions ranged between .86 and .90. The total score that can be obtained from the scale ranges from 24 to 120. Higher scores on the scale indicate a higher level of digital game addiction.

School Engagement Scale: Initially created by Fredricks et al. (2005) and subsequently modified for Turkish by Çengel et al. (2017), this tool was employed to evaluate the participants' levels of school connectedness. The study, conducted at the middle school student level, proved that the scale is suitable for Turkish culture, valid, and reliable. The scale was developed using a 5-point Likert-type rating model. The scale consists of 19 items with three sub-dimensions. Three items are scored in reverse.

The internal consistency of the overall scale, calculated using Cronbach's alpha, was found to be high. The reliability coefficients for the subscales ranged between .68 and .89. A higher score on the scale indicates a higher level of digital game addiction.

The scales used in the research were contacted, and permission for use was obtained from the respective scale owners. The permission processes were conducted via email, and the written approval documents were archived by the researchers. No changes were made to the original structure of the scales; the implementation was carried out in accordance with the guidelines recommended by the developers.

Data Collection

Before initiating the data collection process, the required permissions were secured from the Ministry of National Education, followed by the acquisition of an ethics committee certificate **(**Bartın University Social and Human Sciences Ethics Committee, 12.02.2025, 2025-SBB-0063). In this context, permission to conduct the study was obtained by contacting the administrations of the selected schools and providing detailed information regarding the purpose, scope, and methodology of the research. With the support of the teachers, Parent Consent Forms were distributed to the students. Students were informed in writing and verbally that participation is voluntary. Additionally, a brief overview of the research topic, scope, and methodology was provided. The research was conducted during the spring semester of the 2024-2025 academic year, from March to May 2025.

Research data were collected online through Google Forms. In the introduction section of the form, participants were informed about the purpose of the research, privacy principles, and the principle of voluntary participation. Students' participation was entirely based on the principle of voluntariness, and no personal information was requested. The data has been automatically recorded and stored in the Google Form system. The data were accessed only by the researcher. The obtained data were included in the analysis phase after excluding incomplete or incorrectly filled forms.

Informed voluntary participation/consent forms were delivered to the students' parents, and written permissions were collected face-to-face. No student was included in the research without obtaining consent from their parents. The implementation was carried out in the school environment and during class hours, under the supervision of the researcher. Students filled out the online form in a computer lab or a smart board-supported classroom environment. During the data collection process, the researcher and the relevant teacher were present in the classroom; the students were provided with the necessary technical guidance, but their responses were not interfered with. The completion of the form took an average of 15–20 minutes.

Data Analysis

The data obtained within the scope of the research were analyzed using the SPSS 26.0 software package. First, in order to determine the appropriateness of the analyzes and whether the assumptions were met, missing, erroneous, or outlier data were examined, and normality tests were applied. In this context, the data of 6 participants were excluded from the analysis. The normality of the data was evaluated using skewness, kurtosis, and the Shapiro–Wilk tests; it was determined that the skewness and kurtosis values were within the ±1 range and that the Shapiro–Wilk test results were not significant ($p > .05$). These findings indicate that the data meet the assumption of normal distribution. Therefore, parametric tests were used in the analyzes. In all applications conducted during the analysis process, the statistical significance level was accepted as $p<0.05$.

Cronbach's Alpha (α) coefficients were calculated to determine the internal consistency and reliability of the data collection tool used in the study. In this context, the coefficient values are $\alpha = .975$ for the Digital Game Addiction Scale, the alpha for the School Commitment Scale was found to be .868. When the two scales are evaluated together, the reliability coefficient is found to be $\alpha = .966$. Thus, it indicates that the data collection tools used within the scope of the research are highly reliable. Nunnally and Bernstein (1994) state that Cronbach's alpha values of 70 and above are acceptable; values above 80 are good. Those over 90 indicate an excellent level of reliability.

Frequency and percentage values were calculated to determine the demographic characteristics of the research group and general trends regarding key variables. The distribution of data regarding participants' gender, grade level, and participation in school sports was explained. The Independent Samples T-Test was applied to determine whether the digital game addiction and school attachment scores of the research group showed a significant difference based on gender and participation in school sports. To examine whether digital game addiction and school attachment scores differed by grade level, a One-Way Analysis of Variance (ANOVA) was applied. First, the Levene's test was applied to test the homogeneity of variances, and since the assumption was not met, the Post Hoc Games-Howell test was applied. Pearson Correlation Analysis was conducted to determine the relationship between digital game addiction and school attachment levels.

Findings

Prior to the analysis, the normality of the data was examined. In this context, skewness, kurtosis, and Shapiro–Wilk test results were evaluated. The results of the normality test are presented in Table 2.

Table 2.

Normality Test Results

Scale	N	Skewness	Kurtosis	Shapiro-Wilk	p
Digital Game Addiction Scale	416	-0,421	-0,285	0,972	,064
School Engagement Scale	416	-0,365	-0,198	0,978	,081

The skewness and kurtosis values are within the acceptable range of ±1, and Shapiro–Wilk test results are non-significant ($p > .05$), indicating that the data are normally distributed. Therefore, parametric tests were used in the analysis.

The reliability of the data collection instruments was examined prior to the analysis. In this context, Cronbach’s alpha coefficients for the Digital Game Addiction Scale and the School Engagement Scale were calculated. The reliability results are presented in Table 3.

Table 3

Cronbach's Alpha Reliability Coefficients for the Scales

Scale	Cronbach's Alpha (α)	N	Number of Items
Digital Game Addiction Scale	0,975	416	24
School Engagement Scale	0,868	416	19

As presented in Table 3, the Cronbach's alpha coefficient was found to be α = .975 for the Digital Game Addiction Scale and α = .868 for the School Engagement Scale. These values indicate that both scales demonstrate high internal consistency.

Differences in Digital Game Addiction Scale (DGAC) scores according to participation in school sports were examined. In this context, an independent samples t-test was applied. The results are presented in Table 4.

Table 4

T-Test Results for DGAC According to Participation in School Sports

Scale	Subdimension	Participation Status	N	X̄	SD	f	t	p
Digital Game Addiction Scale	Excessive Focus on and Conflict Related to Digital Gaming	Participating	174	2,224	0,902	58,924	-8.149	.000
		Not Participating	242	3,079	1,151			
	Tolerance Development During Gameplay and Value Attributed to Gaming	Participating	174	2,543	0,971	1.394	-7.237	.000
		Not Participating	242	3,249	0,987			
	Postponement of Individual and Social Duties/Responsibilities	Participating	174	2,057	0,881	96.058	-7.512	.000
		Not Participating	242	2,863	1,202			
	Psychological–Physiological Reflections of Withdrawal and Immersion in Gaming	Participating	174	2,129	0,966	60.730	-7.151	.000
		Not Participating	242	2,933	1,236			

Table 4 shows the findings for the sub-dimensions of the DGAC on the basis of participation in school sports. A significant difference was observed between students who took part in school sports and those who did not, in the subdimension of excessive focus and conflict related to playing digital games (t=-8.149, p<0.05). In this context, the study found that the average scores of students participating in school sports (X̄ = 2.224) were significantly lower than those of students who did not participate (X̄ = 3.079). Similarly, the results indicated a statistically significant difference between students who participated in school sports and those who did not, in terms of the development of tolerance during the game and the value attributed to the game (t=-7.237, p<0.05). In this context, the average scores of students participating in school sports (X̄ = 2.543) were found significantly lower compared to those who did not participate (X̄ = 3.249). A statistically significant difference was also observed between students who participated in school sports and those who did not in the subdimension of delaying individual and social duties/assignments (t=-7.512, p<0.05). Findings also revealed that the average scores of students participating in school sports (X̄ = 2.057) were significantly lower compared to those who did not participate (X̄ = 2.863). Finally, the study found a statistically significant difference between students who participated in school sports and those who did not in the psychological-physiological reflection of deprivation and the subdimension of immersion in the game (t=-7.151, p<0.05). It was revealed that the scores of students participating in school sports (X̄ = 2.129) were significantly lower than the average scores of students who did not participate (X̄ = 2.933). Finally, a statistically significant difference was found in the "Psychological–Physiological Reflections of Withdrawal and Immersion in Gaming" subdimension (t = -7.151, p < .05). Students who participated in school sports had lower mean scores (X̄ = 2.129) than those who did not participate (X̄ = 2.933).

Differences in School Engagement Scale (SES) scores according to participation in school sports were examined. In this context, an independent samples t-test was applied. The results are presented in Table 5.

Table 5

T-Test Results for the SES Scale According to Participation in School Sports

Scale	Subdimension	Participation Status	N	X̄	SD	f	t	p
School Engagement Scale	Behavioral Engagement	Participating	174	2,885	0,606	0,948	-5,959	.000
		Not Participating	242	3,239	0,592			
	Emotional Engagement	Participating	174	2,450	0,651	0,307	-10,264	.000
		Not Participating	242	3,118	0,657			
	Cognitive Engagement	Participating	174	2,879	0,864	8,302	-5,305	.000
		Not Participating	242	3,302	0,755			

Table 5 presents the analysis results for the subscales of the SES Scale based on students' participation in school sports. A statistically significant difference was found in the Behavioral Engagement subdimension between students who participated in school sports and those who did not ($t = -5.959$, $p < .05$). In this instance, the mean scores of the participating students ($\bar{X} = 2.885$) were markedly inferior to those of the non-participating students ($\bar{X} = 3.239$). There was also a big difference in the Emotional Engagement subscale ($t = -10.264$, $p < .05$). The average score for students who played sports at school was 2.450, which was lower than the average score for those who didn't. Lastly, there was a statistically significant difference in the Cognitive Engagement subdimension ($t = -5.305$, $p < .05$). The average scores of students who played sports at school ($\bar{X} = 2.879$) were much lower than those of students who did not play sports ($\bar{X} = 3.302$).

Differences in the subdimensions of the Digital Game Addiction Scale (DGAC) according to gender were examined. In this context, an independent samples t-test was applied. The results are presented in Table 6.

Table 6

T-Test Results for the Subdimensions of the DGAC by Gender

Scale	Subdimension	Gender	N	X̄	SD	f	t	p
Digital Game Addiction Scale	Excessive Focus on and Conflict Related to Digital Gaming	Female	192	2,486	1,107	1,106	-4.066	.001
		Male	224	2,932	1,119			
	Tolerance Development During Gameplay and Value Attributed to Gaming	Female	192	2,771	1,062	3.070	-3.371	.001
		Male	224	3,114	1,000			
	Postponement of Individual and Social Duties/Responsibilities	Female	192	2,365	1,102	7.460	-2.748	.006
		Male	224	2,673	1,173			
	Psychological–Physiological Reflections of Withdrawal and Immersion in Gaming	Female	192	2,390	1,194	0.499	-3.352	.001
		Male	224	2,781	1,178			

Table 6 presents the results of the independent samples t-test examining the subdimensions of the Digital Game Addiction Scale (DGAC) by gender. The findings indicate that there are statistically significant differences between female and male students across all subdimensions of the scale. A statistically significant difference was found in the subdimension of excessive focus on and conflict related to digital gaming ($t = -4.066$, $p < .05$). The results revealed that the mean score of female students ($\bar{X} = 2.486$) was lower than that of male students ($\bar{X} = 2.932$). Similarly, a significant difference was observed in the subdimension of tolerance development during gameplay and the value attributed to gaming ($t = -3.371$, $p < .05$). The analysis showed that female students had lower mean scores ($\bar{X} = 2.771$) compared to male students ($\bar{X} = 3.114$). In the subdimension of postponement of individual and social duties/responsibilities, a statistically significant difference was also identified ($t = -2.748$, $p < .05$). The findings indicated that the mean score of female students ($\bar{X} = 2.365$) was lower than that of male students ($\bar{X} = 2.673$). Finally, a statistically significant difference was found in the subdimension of psychological–physiological reflections of withdrawal and immersion in gaming ($t = -3.352$, $p < .05$). The results demonstrated that female students ($\bar{X} = 2.390$) had lower mean scores compared to male students ($\bar{X} = 2.781$).

Differences in the subdimensions of the School Engagement Scale (SES) according to gender were examined. In this context, an independent samples t-test was applied. The results are presented in Table 7.

Table 7

T-Test Results for the Subdimensions of the SES Scale by Gender

Scale	Subdimension	Gender	N	X̄	SD	f	t	p
School Engagement Scale	Behavioral Engagement	Female	192	3,059	0,575	4,417	-0,968	.334
		Male	224	3,118	0,663			
	Emotional Engagement	Female	192	2,761	0,710	1,651	-2,074	.039
		Male	224	2,911	0,746			
	Cognitive Engagement	Female	192	3,000	0,878	6,272	-2,871	.004
		Male	224	3,236	0,773			

Table 7 presents the results of the independent samples t-test examining the subdimensions of the School Engagement Scale (SES) by gender. The findings indicate that gender-based differences vary across the subdimensions of the scale. No statistically significant difference was found between female and male students in the Behavioral Engagement subdimension ($t = -0.968$, $p > .05$). Although male students ($\bar{X} = 3.118$) had slightly higher mean scores than female students ($\bar{X} = 3.059$), this difference was not statistically significant. In contrast, a statistically significant difference was observed in the Emotional Engagement subdimension ($t = -2.074$, $p < .05$). The analysis revealed that female students ($\bar{X} = 2.761$) had lower mean scores compared to male students ($\bar{X} = 2.911$). Similarly, a statistically significant difference was found in the Cognitive Engagement subdimension ($t = -2.871$, $p < .05$). The results indicated that the mean scores of female students ($\bar{X} = 3.000$) were lower than those of male students ($\bar{X} = 3.236$).

Differences in the mean scores of the Digital Game Addiction Scale (DGAC) according to grade level were examined. In this context, one-way ANOVA and Games–Howell post hoc tests were applied. The results are presented in Table 8.

Table 8

ANOVA and Post Hoc Games-Howell Test Results for Mean Scores of the DGAC Scale by Grade Level

Grade Level	N	X̄	SD	f	p	Significant Differences
5th Grade (5)	108	2,861	1,023			
6th Grade (6)	72	3,045	1,023			
7th Grade (7)	106	2,864	1,152	10,642	,000	5-8, 6-8, 7-8
8th Grade (8)	130	2,305	0,953			
Total	**416**	**2,720**	**1,072**			

Table 8 shows the average scores on the DGAC scale by grade level, as well as the results of the ANOVA and Post Hoc Games-Howell tests. There was a statistically significant difference between the average scores of the DGAC based on grade level ($f=10.642$, $p<0.05$). It was decided that the 8th-grade average score ($\bar{X} = 2.305$) was much lower than the average scores for the 5th grade ($\bar{X} = 2.861$), 6th grade ($\bar{X} = 3.045$), and 7th grade ($\bar{X} = 2.864$).

Differences in the mean scores of the School Engagement Scale (SES) according to grade level were examined. In this context, one-way ANOVA and Games–Howell post hoc tests were applied. The results are presented in Table 9.

Table 9

ANOVA and Post Hoc Games-Howell Test Results for Mean Scores of the SES Scale by Grade Level

Grade Level	N	X̄	SD	f	p	Significant Differences
5th Grade (5)	108	3,045	0,676			
6th Grade (6)	72	3,169	0,682			
7th Grade (7)	106	3,087	0,668	3,725	,012	6-8
8th Grade (8)	130	2,880	0,583			
Total	**416**	**3,02**	**0,654**			

Table 9 presents the mean scores of the School Engagement Scale (SES) according to grade level, along with the results of the one-way ANOVA and the Games–Howell post hoc test. The analysis revealed a statistically significant difference in SES scores across grade levels ($F = 3.725$, $p < .05$). According to the results of the Games–Howell post hoc test, the significant difference was observed between 6th-grade and 8th-grade students. In this context, it was determined that the mean score of 8th-grade students ($\bar{X} = 2.880$) was lower than that of 6th-grade students ($\bar{X} = 3.169$).

The relationships between the subdimensions of the Digital Game Addiction Scale (DGAC) and the School Engagement Scale (SES) were examined. In this context, Pearson correlation analysis was conducted. The results are presented in Table 10.

Table 10

Pearson Correlation Analysis Results for the Subdimensions of the DGAC and SES Scales

	SES1	SES2	SES3	DGAC1	DGAC2	DGAC3	DGAC4
Behavioral Engagement (SES1)	1						
Emotional Engagement (SES2)	,679**	1					
Cognitive Engagement (SES3)	,613**	,645**	1				
Excessive Focus on and Conflict Related to Digital Gaming (DGAC1)	,570**	,634**	,587**	1			
Tolerance Development During Gameplay and Value Attributed to Gaming (DGAC2)	,532**	,616**	,580**	,876**	1		
Postponement of Individual and Social Duties/Responsibilities (DGAC3)	,575**	,620**	,512**	,928**	,847**	1	
Psychological–Physiological Reflections of Withdrawal and Immersion in Gaming (DGAC4)	,540**	,586**	,496**	,890**	,843**	,930**	1

The findings of the Pearson correlation analysis between the subdimensions of the DGAC and SES scales are illustrated in Table 10. The analysis demonstrated a statistically significant positive correlation between all subdimensions of the DGAC scale and the subdimensions of school engagement. The correlations between the behavioral component of the SES and the subdimensions of the DGAC scale ranged from $r = .532$ to $r = .575$. The correlations with the affective aspect varied from $r = .586$ to .634, and the correlations with the cognitive aspect varied from $r = .496$ to .587.

Discussion

The study investigated the relationship between middle school kids' digital gaming addiction and their academic engagement, with a particular focus on their involvement in sports activities. The average scores of participants regarding digital game addiction and school connection were analyzed in relation to their involvement in school sports, as well as demographic factors like gender and grade level. A correlation analysis was conducted to examine the relationship between the subdimensions of digital gaming addiction and levels of school attachment.

The main aim of the study was to examine the levels of digital game addiction among middle school students by taking into account their participation in school sports. The findings revealed statistically significant differences across all four subdimensions of the Digital Game Addiction Scale. Table 4 presents the results in detail. The results indicate that students who participate in school sports have lower mean scores in the subdimension of excessive focus on and conflict related to digital gaming compared to those who do not participate ($\bar{X} = 2.224 < 3.079$; $t = -8.149$; $p < .001$). Similarly, in the subdimension of tolerance development during gameplay and the value attributed to gaming, it was found that students participating in school sports had lower mean scores than non-participating students ($\bar{X} = 2.543 < 3.249$; $t = -7.237$; $p <$

.001). In the subdimension of postponement of individual and social responsibilities, students participating in school sports exhibited lower mean scores compared to those who did not participate ($\bar{X}$ = 2.057 < 2.863; t = -7.512; p < .001). Likewise, in the subdimension of psychological–physiological reflections of withdrawal and immersion in gaming, participating students had lower mean scores than their non-participating peers ($\bar{X}$ = 2.129 < 2.933; t = -7.151; p < .001). Overall, the findings suggest that participation in school sports is associated with lower levels of digital game addiction.

A review of the current literature reveals a deficiency of studies exploring the relationship between digital gaming addiction and participation in school sports. Öcal and Metin's (2022) study shows some similarities to this one in terms of themes, but it is different in terms of the scales used, the methods of analysis, and the outcomes. The study demonstrated no substantial disparity in average digital game addiction scores associated with participation in school sports. Consequently, this result deviates from the conclusions of the present investigation. Conversely, there exist studies in the literature that corroborate the present research. Hazar and Ekici (2021) examined the relationship between digital gaming addiction and perceptions of bullying among middle school pupils. They discovered that adolescents engaged in sports had significantly lower digital game addiction ratings compared to their non-sporting counterparts, both in aggregate and in certain sub-dimensions ($\bar{X}$ = 52.62 < 59.15; t = -3.947; p < 0.05). The results of this study align with those found in this research. Hazar et al. (2017) investigated middle school children and found that those who did not engage in regular athletics had higher digital game addiction scores compared to their peers who did participate ($\bar{X}$ = 45.64 < 49.40; t = -1.91; p < 0.05). These results are consistent with the current study, suggesting that physical exercise may function as a protective factor against digital gaming addiction. Moreover, the study conducted by Güvendi et al. (2019) shown that students whose families promoted their participation in physical activity displayed significantly lower digital game addiction ratings compared to those who did not get such encouragement ($\bar{X}$ = 50.09 < 62.43; t = -3.462; p < 0.05). The present research findings correspond with these outcomes.

Overall, it can be said that organized sports events or regular participation in activities involving physical activity have a reducing effect on digital game addiction. One of the recent studies supporting this view is the work by Karaaslan et al. (2023). The investigation revealed a notable and inverse relationship between levels of physical activity and the incidence of digital game addiction among children identified with this condition (r = -0.659; p = 0.001).Based on this finding, it can be stated that as physical activity levels decrease, digital game addiction increases; in other words, participation in physical activity decreases as addiction levels rise. It can be said that one of the factors influencing this result is the concept of leisure time. It is believed that the large portion of free time spent by students participating in sports activities on activities such as training and competitions limits their inclination toward digital games. Booker et al. (2015) stated that the increase in digital screen use as a leisure activity negatively affects participation in sports events.

The results of this study suggest that the connections among involvement in school sports, digital game addiction, and school attachment at the primary education level must be examined within an educational framework. The middle school years are an important time for adolescents to grow and change. They start using digital media more and make friends at school. In this process, physical education classrooms are not just a place for children to be active; they are also a place where students learn how to control themselves, engage with their peers, and acquire a sense of responsibility. The current educational programs in Türkiye and the Türkiye Century Education Model include physical education within a framework that includes movement culture, knowledge of healthy living, and value education. This approach stresses that sports are not just a way to perform, but also a way to control behavior and build healthy habits (Ministry of National Education, 2025).

In the literature, findings showing that as the level of physical activity increases, the scores of digital game addiction decrease (Hazar et al., 2017) indicate that sports can play a balancing role. However, it has also been reported that the quality and continuity of sports participation are decisive; merely having a sports license or attending a sports school may not be sufficient to reduce addiction on their own (Hazar et al., 2020; Yazıcıoğlu Çalışan et al., 2021). This situation highlights the importance of conducting school sports in a structured and pedagogically-based manner. When the findings that extracurricular sports activities strengthen school attachment (Yılmaz, 2019) and the positive relationship between school climate and school

attachment (Dönmez & Taylı, 2018) are considered together, it is understood that formal physical education classes and informal sports activities are two complementary learning areas.

Table 5 presents the results of a T-test on the mean scores of students participating and not participating in school sports on the School Connectedness Scale. The analysis findings showed significant differences between groups in all three subdimensions of the scale. Accordingly, it was determined that the average scores of students participating in school sports in the behavioral dimension were lower compared to those who did not participate ($2.885 < 3.239$; $t = -5.959$; $p < 0.05$). In the affective dimension, the averages of students engaged in school sports were significantly lower than those not involved ($2.450 < 3.118$; $t = -10.264$; $p < 0.05$). Finally, in the cognitive dimension, the commitment levels of students engaged in school sports were inferior to those of non-participating students ($2.879 < 3.302$; $t = -5.305$; $p < 0.05$). A literature review shows that most studies show that being active in sports or physical activity makes students feel more connected to school (Serbest et al., 2025; Yılmaz, 2019; Arslan & Özdemir, 2022; Yanık, 2017). For example, Kangalgil et al. (2024) reported that students participating in school sports teams had significantly higher school attachment scores compared to non-participating students ($3.51 < 3.75$; $t = 2.927$; $p < 0.05$). Similarly, Yanık (2017) found that the school attachment levels of secondary school students who participated in school teams and school-based exercise activities were statistically significantly higher than those of students who did not participate. These findings indicate that sports participation has positive effects on school attachment in the general literature, but they differ from the findings of the current study in terms of results.

When evaluating the results related to school commitment, it is thought that a role conflict may arise for student athletes. Indeed, it is stated that students who primarily identify themselves as athletes participate less in classes and their interest in academic activities weakens (Santos & Sagas, 2023). It is emphasized that it is quite difficult to pursue both school and sports simultaneously, especially for young people; this situation is stated to even lead to some students dropping out of school (Tudor and Ridpath, 2019). Even though school sports may seem like extracurricular activities, the fact that they often happen at the same time as school hours can make it harder for students to do their schoolwork. A large number of students who play sports at school are also athletes who are active in sports clubs outside of school. Therefore, it is likely that the athlete role will become dominant in these students. The intensity of match and training schedules can weaken a student's connection to school and cause them to prioritize academic responsibilities.

Middle school is when students start to figure out who they are as students and how they feel about education. In this process, physical education classes aren't simply places to get exercise; they're also structured, formal learning environments where kids learn how to be responsible, work together, and feel like they belong. At present time, physical education is seen to be a way to help kids grow in many areas, such learning about values, healthy living, and movement culture. In this perspective, sports are not viewed as detrimental to academic achievement; instead, they are regarded as a pedagogical instrument that facilitates adaptability to the educational environment (Ministry of National Education, 2025).

The literature on school attachment emphasizes that strengthening a student's affective, behavioral, and cognitive ties to the school environment reduces the risk of absenteeism and school dropout. In this study, significant differences between participation in school sports and the sub-dimensions of school attachment indicate that sports may support the relationship between students and their school. Sports activities provide students with the opportunity to be visible within the school, interact with peer groups, and experience success. These experiences can particularly strengthen the dimensions of behavioral and affective engagement. Findings indicating that extracurricular sports activities increase school belonging (Yılmaz, 2019) and studies revealing the positive relationship between school climate and commitment (Dönmez & Taylı, 2018) show that sports are not only a physical but also a social and emotional learning domain.

Table 6 shows the average scores of the students who took part in the study on the Digital Game Addiction Scale, broken down by gender. The analysis results demonstrate statistically significant gender differences across all four subdimensions of the scale. So, it was found that the average scores of female students were lower than those of male students in the area of too much focus and conflict related to playing digital games ($2.486 < 2.932$; $t = -4.066$; $p < 0.05$). In the same way, it was noticed that female students'

average scores were much lower than male students' in terms of developing tolerance during game time and the value dimension of the game (2.771 < 3.114; t = -3.371; p < 0.05). In terms of delaying individual and social tasks/assignments, female students also have lower dependence scores (2.365 < 2.673; t = -2.748; p < 0.05). Finally, it was found that the average scores of female students were significantly lower than those of male students in the psychological-physiological reflection of deprivation and the game immersion subdimension (2.390 < 2.781; t = -3.352; p < 0.05). A review of the literature reveals that findings corroborating the current research results are prevalent. Ekinci et al. (2017) found that male high school students were much more likely to be addicted to digital games than female students (11.62 < 14.69; t = -10.74; p < 0.05). A study by Hazar and Ekici (2021) on middle school students revealed that male students exhibited elevated levels of addiction across both the overall scale score and all sub-dimensions. In a study by Küçük and Çakır (2020) on middle school students, it was also found that male students were significantly more addicted to digital games than female students. Various academic fields elucidate the potential causes of this situation in the literature. Dong and Potenza (2022) highlighted neurobiological and psychological mechanisms, stating that men have stronger reward systems associated with gaming, show higher sensitivity to game-related stimuli, and this increases the risk of addiction. Gisbert-Perez et al. (2024) stated that male students spend more time on digital games than female students, and that long-term gaming participation is one of the key factors increasing the risk of addiction. When these findings are considered together, it can be said that the higher levels of digital game addiction among male students may be related to both neurobiological sensitivity and behavioral usage patterns.

Table 7 presents the mean scores of the students participating in the study on the School Engagement Scale, categorized by gender. The analysis findings indicate that statistically significant differences vary across the subdimensions of the scale. Accordingly, it was determined that the average scores of male students on the scale in the behavioral dimension were higher than those of female students (3.059 < 3.118; t = -0.968; p > 0.05); however, this difference was not statistically significant. In the same way, it was found that male students' school engagement scores in the affective dimension were higher than those of female students (2.761 < 2.911; t = -2.074; p < 0.05), and this difference was statistically significant. In the cognitive dimension, it was ascertained that the mean scores of male students exceeded those of female students (3.000 < 3.236; t = -2.871; p < 0.05), indicating a statistically significant difference. A review of the literature indicates that the degree of school attachment varies by gender. Tuğrul (2021) found that male middle school students were more attached to school than female middle school students, which is in line with the results of this study (50.46 < 54.45; t = 3.80; p < 0.05). Johnson et al. (2006) demonstrated that gender differences can fluctuate by grade level; they observed that female students exhibited higher levels of attachment in middle school, whereas male students' attachment levels rose with advancing grade levels. Conversely, Kangalgil et al. (2024) identified no significant differences between boys and girls in their study of middle school students. A comprehensive review of these studies reveals that the correlation between school attachment and gender lacks a uniform pattern in the literature, as disparate results arise from various studies. People think that the differences in the sample's traits, like the level of education, the cultural context, the school climate, and the tools used to measure things, are what made this happen.

Table 8 shows how the scores of middle school students on the DGAC Scale changed based on the class variable in the study. The analyses demonstrated a statistically significant difference between grade level and digital game addiction (F = 10.642; p < 0.05). The average scores show that 8th graders ($\bar{X}$ = 2.305) are much less likely to become addicted than 5th graders ($\bar{X}$ = 2.861), 6th graders ($\bar{X}$ = 3.045), and 7th graders ($\bar{X}$ = 2.864). Upon reviewing the literature on class variables, it is clear that studies produce inconsistent findings. Marufoğlu and Kutlutürk (2021) contended that their research on middle school students indicated that grade level did not significantly influence digital game addiction. Likewise, Kaman and Bulut (2024) did not find a notable difference in addiction scores based on grade level. In contrast, Küçük and Çakır (2020) discovered that 8th-grade students exhibited higher digital game addiction scores than their counterparts in other grade levels, resulting in a divergent outcome from the present study. When these studies are analyzed collectively, it is apparent that digital game addiction does not demonstrate a uniform pattern in the literature concerning grade level, and notable discrepancies are evident among the studies. The results of this study indicate that the addiction scores of 8th-grade students were probably lower, mainly due to their exam preparation, extended study periods, and reduced gaming time. This situation shows that people are

less likely to play video games when they are stressed out about school and need to learn how to use their time better. This makes it less likely that they will become addicted.

Table 9 displays the School Engagement Scale scores for middle school students, categorized by grade level. The analysis results indicate a statistically significant difference in school engagement levels according to grade level ($F = 3.725$; $p < 0.05$). When examining the mean scores, it was found that 8th-grade students ($\bar{X} = 2.880$) had lower levels of school engagement compared to 5th-grade students ($\bar{X} = 3.045$), 6th-grade students ($\bar{X} = 3.169$), and 7th-grade students ($\bar{X} = 3.087$). Post-hoc analysis indicated that the significant difference was between 6th-grade and 8th-grade students. Additionally, the literature contains studies that identify similar trends. Bellici (2015) found that middle school students' attachment to school decreased as their grade level went up. Similarly, Ceylan and Özgenel (2022) also found that students' school attachment decreased as grade level increased. These findings are consistent with the results of the current research. When considering the rationale for this situation, it is thought that factors such as increased academic pressure and test anxiety as students progress through grade levels, psychosocial changes specific to adolescence, and differing priorities in the social environment can affect school attachment. Especially in the upper grades, the intensification of academic expectations and the shift of students' interests toward extracurricular activities can weaken their commitment to school.

Finally, Table 10 presents the results of the correlation analysis regarding the relationships between the mean scores of students on the DGAC scale and the School Connectedness Scale. The analysis findings indicate positive and significant relationships between all subdimensions of the DGAC scale and the subdimensions of the school attachment scale. Accordingly, it was determined that the correlation coefficients between the behavioral dimension of school commitment and the sub-dimensions of digital game addiction ranged from $r = .532$ to $r = .575$, the relationships between the affective dimension and the sub-dimensions ranged from $r = .586$ to $r = .634$, and the relationships between the cognitive dimension and the sub-dimensions ranged from $r = .496$ to $r = .587$. It is believed that this result is particularly related to the characteristics of the sample group included in the study. The results show that students who play sports at school have lower scores on both the digital game addiction and school attachment scales. On the other hand, students who don't play sports at school have higher scores on both scales. This situation may have resulted in elevated correlation coefficients due to the scores from the two scales fluctuating in the same direction within the same group. As a result, it can be said that the positive relationships found in this study are a sign of a pattern that comes from the way the sample group was set up, so the results need to be looked at in context.

Recommendations

Based on the research findings, various suggestions have been developed for relevant institutions and future studies on the topic. First of all, planning competitions held within the scope of school sports outside of class hours as much as possible will reduce the negative impact on student athletes' academic processes. In this regard, it is important to prepare and implement remedial programs for students participating in sports activities when necessary. To effectively manage this process, regular communication and cooperation must be established between physical education and sports teachers, school administration, and parents. Providing awareness-raising training for parents on digital games, game addiction, and controlled digital game use will also contribute to guiding students' behavior in a healthy way. Additionally, conducting future research on students from different socioeconomic levels and different types of schools will increase the generalizability of the findings. To gain a deeper understanding of the topic, the use of qualitative research designs and the examination of student experiences from a holistic perspective are also recommended for future studies.

From the perspective of educational sciences, physical education classes aim for outputs such as self-regulation, responsibility, cooperation, and value acquisition alongside psychomotor development as a planned part of the formal learning process; school sports serve as a complementary structure that creates the application and reinforcement area for these gains. Extracurricular sports activities, being based on voluntary participation, can be considered semi-formal/informal learning environments that strengthen students' motivation, social identity, and sense of belonging. According to the findings, the lower digital game addiction scores of students participating in school sports suggest that sports may have a positive impact on

behavior regulation by supporting time management and self-control skills. At the same time, the sports environment can contribute to strengthening the sense of school attachment by increasing student-teacher and peer interactions. In this context, establishing a more systematic integration between physical education classes and school sports, relating lesson achievements to school teams and club activities, and encouraging primary education students' participation in extracurricular sports activities are important for educational policies; as strengthening the pedagogical function of sports can lead to increased school attachment and a more holistic and sustainable educational approach to reducing behavioral risks such as digital game addiction.

Conclusion

The research concentrated on investigating the correlation between digital game addiction and school attachment among middle school students, specifically the influence of participation in school sports. The results demonstrate that students engaged in school sports exhibit statistically significantly lower levels of digital game addiction than their peers who do not participate. This result indicates that sports activities enable students to spend their leisure time in a healthier and more structured way, thus reducing the time spent on digital games. It can be said that the gains sport provides in cognitive, affective, and psychomotor domains play a regulatory function in students' game-playing behavior. In terms of school attachment, it was determined that the attachment levels of students who did not participate in school sports were significantly higher compared to student athletes. It is thought that this situation may be related to the athletic identity of student-athletes taking precedence over their student identity. Especially with the intensity of training and competition schedules, and the time and attention-demanding nature of sports activities, contrary to expectations, the emotional and behavioral attachment of student-athletes to school can be negatively affected. Although there are various inconsistencies in the literature regarding the gender variable, the current research, in line with the literature on digital game addiction, has shown that male students have higher levels of addiction. While a similar inconsistency is noticeable in terms of grade level, the findings of the current study align with some research by showing that school attachment levels decrease as grade level increases. Finally, positive and significant relationships were found between the subscales of both measures. It is assessed that these relationships stem particularly from the characteristics of the sample group and the different score distributions based on their participation in school sports.

CRediT authorship contribution statement

The author contributed to all aspects of the study, including conceptualization, methodology, data collection, formal analysis, writing—original draft preparation, and writing—review and editing.

Declaration of Conflicting Interests

The author claims that there are no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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Ethics Approval and Consent to Participate

This study was conducted in accordance with the ethical standards of scientific research. Prior to the initiation of the data collection process, the necessary permissions were obtained from the Ministry of National Education, followed by ethics committee approval (Bartın University Social and Human Sciences Ethics Committee, 12.02.2025, 2025-SBB-0063). The research protocol was approved by the ethics committee. Participation was voluntary, informed consent was obtained from parents, and anonymity and confidentiality were maintained throughout the study. No data were altered, fabricated, or falsified, and all procedures were carried out in accordance with international standards of publication ethics.

Declaration of AI Usage Statement

The authors affirm that no AI tools were employed in the preparation of this article

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| Systematic Review / Sistematik Derleme|

Systematic Review of Studies on Digital Literacy in Türkiye

Türkiye'de Dijital Okuryazarlığa Yönelik Yapılan Çalışmaların Sistematik İncelenmesi

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Keywords

Digital literacy

Systematic review

Literacies

Abstract

This study aims to examine digital literacy studies conducted at the primary and secondary school levels in Türkiye between 2014 and 2024, according to specific criteria and to determine the general trend in the field This research used a systematic review with PRISMA. The universe of this research sources searched digital literacy studies found in the YÖK Academic [Council of Higher Education (CoHE)], National Thesis Center of the CoHE, Google Scholar search engines, and the National Academic Network and Information Center (ULAKBİM), which includes the index of peer-reviewed and scientific Turkish academic journals. The PRISMA method was used to obtain the research data, and the definition, screening, selection, and inclusion stages were followed. Then, in the separation and inclusion processes, the purposeful sampling method was used in line with the inclusion criteria determined by the researchers. The keyword "digital literacy" was used to support the screening process. The deadline for included studies was given as 03.10.2024. After applying the predefined inclusion and exclusion criteria, the number of studies identified through the digital literacy keyword search was reduced from 893 to 21 theses and 16 articles included in the analysis. In Türkiye, it is observed that the general patterns in processes related to digital literacy primarily focus on prediction and level determination, and that the subject has become more detailed in recent years. It has been determined that the articles and theses cover topics such as program review, scale development and application, skill level, student opinion, digital literacy level, evaluation of programs and textbooks, the success of digital literacy and its effect on permanence. It is observed that the research models used in the articles and theses are screening (qualitative/quantitative), case study and document analysis. The processes carried out are mostly reported at the secondary school level. Document review, interview protocols, and the use of scales or development companies have been identified as data collection tools in the articles and theses.

Anahtar Sözcükler

Dijital okuryazarlık

Sistematik derleme

Okuryazarlıklar

Öz

Bu araştırmada Türkiye'de 2014-2024 yılları arasında ilkokul ve ortaokul düzeyinde yapılan dijital okuryazarlık çalışmalarını belirli ölçütlere göre incelemek ve alandaki genel eğilimi belirlemek hedeflenmiştir. Çalışma tarama modelinde betimsel yaklaşımla gerçekleştirilmiştir. Bu araştırmanın evrenini YÖK Akademik, YÖK Ulusal Tez Merkezi, ULAKBİM ve Google Akademik veritabanlarında yer alan dijital okuryazarlık çalışmaları oluşturmaktadır. Araştırma verilerinin elde edilmesinde PRISMA yönteminden yararlanılmış olup yöntemin tanımlama, tarama, ayırma ve dâhil etme aşamaları süreçte izlenmiştir. Ardından ayırma ve dahil etme süreçlerinde araştırmacılar tarafından belirlenen dahil etme kriterleri doğrultusunda amaçlı örnekleme yöntemi kullanılmıştır. Tarama sürecinin amacına hizmet etmek üzere "dijital okuryazarlık" anahtar kelimesi kullanılmıştır. Dahil edilecek çalışmalar için son tarih 03.10.2024 olarak belirlenmiştir. Dijital okuryazarlık anahtar kelimesi veritabanı araması ile başlangıçta 893 çalışmaya erişilmiş olup, kriterlere yönelik elemeler yapıldığında 21 tez ve 16 makale çalışmaya dahil edilmiştir. Türkiye'de dijital okuryazarlıkla ilgili yapılan çalışmalardaki genel eğilimin daha çok yordama ve düzey tespitinde olduğu ve son yıllarda bu konuyla ilgili yapılan çalışmalarda artış olduğu görülmektedir. Makaleler ve tezlerde program inceleme, ölçek geliştirme ve uygulama, beceri düzeyi, öğrenci görüşü, dijital okuryazarlık düzeyi, program ve ders kitaplarının değerlendirilmesi, dijital okuryazarlığın başarı ve kalıcılığa etkisi gibi başlıkların ele alındığı tespit edilmiştir. Makale ve tezlerde kullanılan araştırma modellerinin tarama (nitel/nicel), durum çalışması ve doküman analizi olduğu; yapılan çalışmaların daha çok ortaokul düzeyindeki öğrencilerle olduğu gözlenmektedir. Makalelerde ve tezlerde veri toplama aracı olarak doküman inceleme, görüşme formu, ölçek kullanma ya da geliştirme kullanıldığı tespit edilmiştir.

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Introduction

The 21st century has witnessed profound changes across sectors, including education, health, security, and both public and personal domains. Numerous terms have emerged to characterize this era, such as “digital age,” “digital life,” “digital world,” and “digital planet.” The concept of “digital” has become central to our existence, prompting a reevaluation of traditional meanings of various concepts. Literacy, in particular, has evolved beyond its conventional definitions. Today, literacy encompasses much more than mere reading and writing skills. The constant development and proliferation of digital technologies have given rise to the concept of digital literacy. Digital literacy can be defined as the ability to effectively use digital technology and the internet to access relevant content, as well as to evaluate, utilize, share, critique, and create that content (Özkaya & Erat, 2022). Individuals are now empowered to access, understand, analyze, and disseminate information through digital tools tailored to their needs (Uçkun, 2024). United Nations Educational, Scientific and Cultural Organization (UNESCO) further articulates digital literacy as "the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital technologies for employment, good jobs, and entrepreneurship" (UNESCO, 2018, p.6).

In information societies, digital literacy is a crucial factor in shaping political and economic strategies for social development and democratization (Etike, 2021). The rapid production and consumption of information, the predominance of digital resources, and the growing emphasis on lifelong learning underscore the significance of digital literacy (Kuru, 2019). Individuals who possess digital literacy are expected to adeptly utilize technology, manage data transfer and storage, locate, download, and install applications, use email, and navigate ethical, moral, and legal considerations. Additionally, they should communicate effectively, employing appropriate language and expressions (Uçkun, 2024).

While engaging in these activities, digitally literate individuals must also access information from reliable sources and critically evaluate its validity (Şahin & Sarıçam, 2022). Therefore, digital literacy should not be confined to merely operating a device or software; rather, it encompasses cognitive, sociological, and emotional processes (Karabacak & Sezgin, 2019). Digital literacy is one of the skills that individuals called global citizens must have (Görmez & Şen, 2021). Digital literacy, which is also perceived as reading and writing on a screen, has become a skill that people can no longer exclude from their lives (Maden et al., 2018). Individuals' ability to address society and develop their knowledge and power depends on acquiring this skill (Direkçi et al., 2019). Being digitally literate also requires individuals to be investigative, questioning, problem-solving, able to make and take decisions, and to have critical thinking skills (Duran & Özen, 2018). In the digital age, the processes of developing effective communication and establishing cooperation on accessing, understanding, interpreting, and sharing information are also very important (Bahşi & Ateş, 2024). Individuals' adaptation to changing conditions and their equipping themselves with the requirements of the age are directly proportional to the extent to which they have acquired digital literacy skills.

In recent years, digital literacy has increasingly been conceptualized not only as an individual competence but also as an essential educational outcome, particularly within compulsory education. Digital literacy education refers to the systematic development of students’ abilities to access, analyze, evaluate, create, and communicate information using digital technologies in a critical, ethical, and responsible manner (Hobbs, 2010; Ng, 2012). In this respect, schools play a central role in equipping learners with the foundational digital skills required to participate effectively in contemporary society.

At the international level, digital literacy education has been integrated into primary and secondary school curricula through various frameworks and policy documents. For instance, UNESCO emphasizes digital literacy as a core component of education for sustainable development and lifelong learning, highlighting its role in fostering critical thinking, citizenship, and employability skills (UNESCO, 2018). Similarly, the European Commission’s DigComp framework defines digital competence as a multidimensional construct encompassing information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. It underscores the importance of introducing these competencies progressively across school levels (Carretero Gomez et al., 2017).

In Türkiye, digital literacy has received increasing attention in national education policies and curricula, particularly in compulsory education. Digital competencies are addressed across subjects and grade levels rather than confined to a single course, reflecting an interdisciplinary approach. Primary and secondary school curricula emphasize skills such as information literacy, media literacy, digital citizenship, and ethical use of technology, aiming to prepare students for the demands of the digital age. This curricular orientation highlights the need for empirical research focusing specifically on how digital literacy is conceptualized, implemented, and studied at these educational levels.

Digital literacy is widely acknowledged as a multifaceted construct comprising cognitive, technical, social, and ethical dimensions (Ng, 2012; van Laar et al., 2017). Beyond technical skills, it involves critical evaluation of digital content, awareness of digital safety and security, understanding of digital rights and responsibilities, and ethical participation in online environments. Consequently, digital literacy is closely related to other contemporary literacy forms, such as media literacy and citizenship literacy. These literacy domains share common conceptual ground in areas including digital ethics, digital law, online security, intellectual property, cybercrime, digital rights, and responsibilities, thereby reinforcing their interconnectedness (Hobbs, 2010; Livingstone, 2014).

Given the increasing exposure of children and adolescents to digital environments, the primary and secondary school years are a critical period for developing digital literacy skills. Research conducted at these levels is particularly important for understanding how digital literacy is fostered within formal education settings and how students and teachers engage with digital competencies in practice. Therefore, examining digital literacy studies conducted at the primary and secondary school levels provides valuable insights into both educational practices and research trends in this field.

The purpose of this research is to examine digital literacy studies conducted at the primary and secondary school levels in Türkiye between 2014 and 2024, applying specific criteria, and to determine the general research trends in this field. Although studies on digital literacy research have addressed it from a bibliometric or thematic perspective (Bahşi & Ateş, 2024; Erat & Özkaya, 2022; Yeşiltaş et al., 2023), these studies predominantly approach digital literacy broadly and comprehensively, without focusing specifically on school-level distinctions. In this context, numerous studies conducted at the primary and secondary school levels within the specified time frame have been identified (Duran & Özen, 2018; Maden et al., 2018; Aydemir et al., 2019; Direkçi et al., 2019; Zurnacı Parlak, 2019; Çelik, 2021; Erdoğan, 2021; Görmez & Şen, 2021; Gür et al., 2021; İpek Süslü, 2022; Laçin, 2021; Nerse, 2021; Özaydın & Kumral, 2021; Taşçı Ağaoğlu & Durmaz, 2021; Üstündağ, 2021; Aydoğdu, 2022; Şahin et al., 2022; Ekemen, 2022; Kaptan, 2022; Kasap, 2022; Metin, 2022; Şahin & Sarıçam, 2022; Vural, 2022; Bayzan et al., 2023; Gürbüz, 2023; Karakuş Yılmaz et al., 2023; Demirel & Çaydere, 2023; Koç, 2023; Aşçı, 2024; Banaz, 2024; Berkay & Hazar, 2024; Bucak, 2024; Durmuş, 2024; Gönen, 2024; Gülmez, 2024; Kartal, 2024; Kök, 2024). However, despite the growing number of studies, there is a noticeable gap in the literature for a systematic, comprehensive analysis of digital literacy research conducted at the primary and secondary school levels in Türkiye over the past 10 years. The deadline for included studies was given as 03.10.2024. Existing reviews tend to overlook school-level differentiation, methodological tendencies, sample characteristics, research designs, and thematic orientations specific to compulsory education. Therefore, this study aims to fill this gap by examining primary and secondary school–level digital literacy studies conducted between 2014 and 2024 within a clearly defined analytical framework, thereby revealing current trends, research priorities, and methodological patterns in the field. In doing so, the study seeks to contribute to the digital literacy literature by providing a focused and level-specific overview that can inform future research and educational practices. This research aims to examine digital literacy studies conducted at the primary and secondary school levels in Türkiye from 2014 to 2024, using specific criteria to identify general trends in the field. In line with this aim, the following research questions were investigated.

1. What are the publication years, publication type, and grade level of the analyzed digital literacy studies?

2. What are the topics of the analyzed digital literacy studies?

3. What is the design/research method of the studies?

4. What is the method/technique/strategy/measurement tool applied in the studies?
5. What is the sample of the studies?
6. What methods were used in the analyzed digital literacy studies?
7. What are the impact and results of the analyzed digital literacy studies?

Method

Research Design

This research aims to investigate digital literacy studies conducted at primary and secondary school levels in Türkiye from 2014 to 2024, using specific criteria to identify the general trends in this field. It employs a descriptive approach within a descriptive survey design. The survey model is designed to portray a past or present situation as it exists, focusing on defining the individual or object of study within its context and as it is (Karasar, 2012).

Data Collection Process

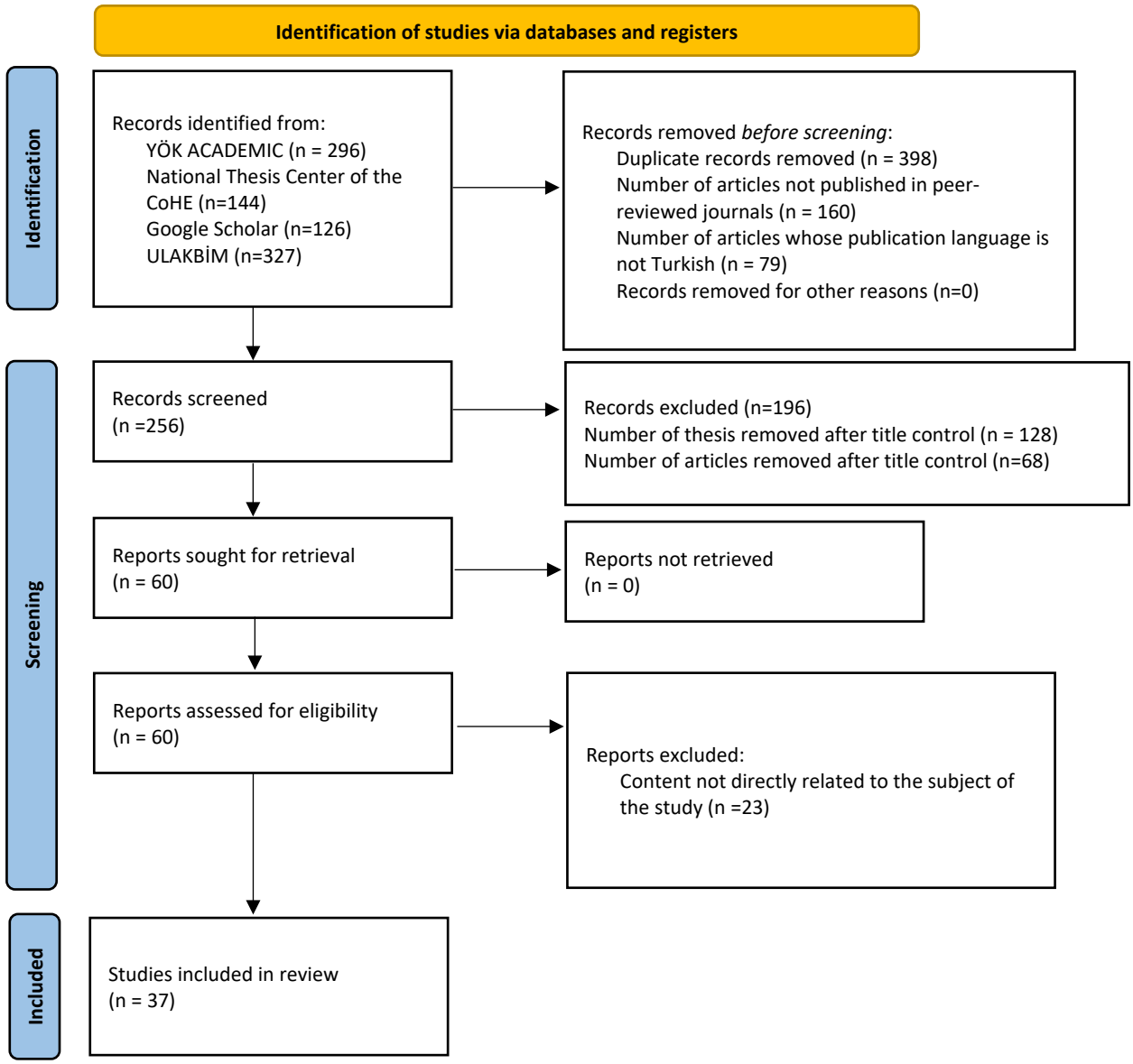
The population of this research consists of digital literacy studies in YÖK Academic (Council of Higher Education). This is a system that provides electronic access, from a single point, to the personal academic information and scientific/academic activity outputs of academics working in Turkish higher education. National Thesis Center of the CoHE, Turkish Academic Network and Information Center and Google Scholar databases. The PRISMA method was used to obtain the research data, and the definition, screening, selection, and inclusion stages were followed. According to the PRISMA method, searches were first conducted across the defined databases used in the research (Page et al., 2021). Then, in the separation and inclusion processes, the purposeful sampling method was used in line with the inclusion criteria determined by the researchers. A literature study was conducted in line with the inclusion criteria, and separate processes were used to screen theses and articles. The keyword "digital literacy" was used to support the screening process. The studies that met the criteria were included. Although 893 studies were initially reached with the digital literacy keyword database search, 21 theses and 16 articles were reached when the criteria were eliminated. The studies to be examined within the scope of the study were selected according to specific criteria. These criteria are listed as follows:

1. The studies were conducted between 2014 and 2024,
2. Since the study focuses on digital literacy, this focus is already explicitly stated in the title.
3. The focus on primary and secondary school levels was intentional, as these levels constitute the core of compulsory education in Türkiye, where digital literacy is systematically addressed through national curricula. This restriction enabled a more focused and comparable analysis of studies conducted within a shared educational and policy context,
4. The publication language of all theses included in the study was Turkish, as they were obtained from the National Thesis Center of the CoHE. Likewise, the articles examined in the study were published in Turkish.
5. The articles were studies published in refereed journals and were not produced from theses.

The deadline for included studies was given as 03.10.2024. The flow chart summarising the data collection process, carried out according to the PRISMA method and in line with the inclusion and exclusion criteria determined by the researchers, is presented in Figure 1. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method is a widely used reporting framework designed to ensure transparency, systematic identification, screening, eligibility assessment, and inclusion of studies in systematic reviews (Page et al., 2021).

Figure 1

Flowchart Summarising the Data Collection Process



Data Analysis

This study aims to explore digital literacy research conducted in primary and secondary schools in Türkiye from 2014 to 2024, based on specific criteria to identify overall trends in the field. The researchers employed a research information form and utilized descriptive content analysis techniques to analyze the data. Descriptive content analysis is a systematic approach that examines existing studies on the topic, identifies their trends, and evaluates their findings descriptively (Çalık & Sözbilir, 2014; Lin et al., 2013). This information form encompasses the study's identity, publication type, applied strategy, method or technique, grade level, research method, pattern, number of participants, effect (result), data analysis method, and the type or structure of the data collection tools utilized. The data entered into the research information form are interpreted in the findings section, with consideration of the categories specified in the form.

Validity and Reliability

During the data analysis process, both researchers independently analyzed 20 percent of the theses, and the resulting categories were compared. Intercoder agreement was calculated using the formula proposed by Miles and Huberman (1994), which is based on the ratio of agreements to the total number of agreements and disagreements: Agreement/(Agreement + Disagreement) × 100. Based on this calculation, the agreement between the researchers was 92%, indicating a high level of reliability in the coding process.

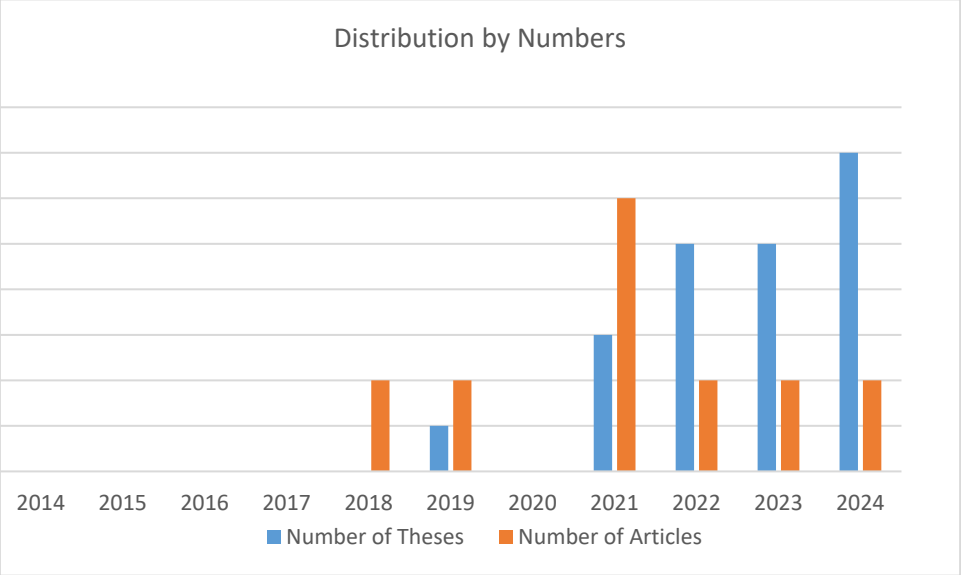
Since the agreement between the researchers was found to be sufficient, the remaining part of the data analysis was completed by one researcher, and the other researcher checked whether the obtained data was correctly tabulated.

Findings

In this section, research findings are presented under separate headings, including publication year, research type, school level, topics, research methods and designs used, strategies, techniques and measurement methods, sample sizes, analyses, and impact and results. The findings are presented in tables and interpreted according to the headings provided. The distribution of studies that meet the research criteria by year is illustrated in Figure 2.

Figure 2

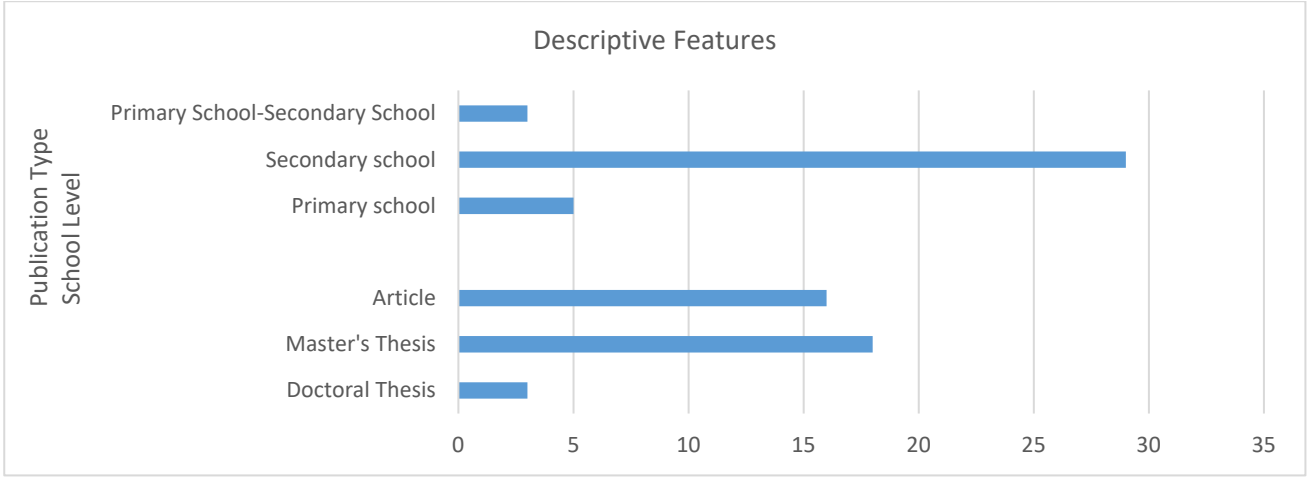
Distribution of Studies by Publication Year (X-Axis: Year, Y-Axis: Frequency)



Upon examining Figure 2, it is evident that no digital literacy studies were conducted at the primary and secondary school levels during 2014-2018. However, the number of studies, particularly thesis research, began to increase notably from 2021 onward. The absence of any studies in 2020 is an intriguing finding within this research. The global impact of the COVID-19 pandemic may plausibly explain this gap. Figure 3 presents the descriptive characteristics of the studies that met the research criteria, categorized by publication type and grade level.

Figure 3

Descriptive Characteristics of the Studies



When Figure 3 is examined, it is seen that the studies included and separated by the research's inclusion and exclusion criteria are mostly theses and secondary school-level studies. It is evident that digital literacy studies at the primary school level cover only 8 of 37 studies. In addition to the descriptive characteristics of the studies examined in this research, the subject of the study, research model, method, applied method, technical strategy/measurement tool, sample, data analysis method, and impact/outcome are presented separately for articles and theses in the separate tables below and interpreted under the relevant headings.

Table 1

Descriptive Information About the Studies of Articles

Study	Publication Type	Design/Research Method	Class/ School Level	Applied Method Technique Strategy/Measurement Tool	Sample/N	Data Analysis Method
Banaz (2024)	Article	Qualitative	Secondary school	Document Analysis	2024 Türkiye Century Maarif Model	Content analysis
Berkay & Hazar (2024)	Article	Quantitative / Survey Model	Primary school 2nd, 3rd, 4th Grade	Scale Development	619	
Bayzan et al. (2023)	Article	Quantitative / Survey Model	Primary school - Secondary school	Global Kids Online framework	10.475	
Duran & Ertan Özen (2018)	Article	Qualitative	Primary school - Secondary school	Document Analysis	2018 Turkish Course Curriculum - Turkish course books prepared for primary and secondary schools	Content analysis
Erdoğan (2021)	Article	Quantitative /Relational screening design	5th grade	Personal Information Form Digital Literacy Scale Cyberbullying Scale	255	
Özaydın & Kumral (2021)	Article	Qualitative-Holistic Single Case Study	3rd, 4th, 5th grade	Interview Form	6	
Şahin et al. (2022)	Article	Quantitative	2nd, 3rd Grade	Scale Development	327	
Aydemir et al. (2019)	Article	Quantitative	4th Grade	Scale Development	31	
Üstündağ (2021)	Article	Quantitative / Survey Model	5th, 6th, 7th, 8th grade	Digital Literacy Scale / Personal Information Form	237	Independent Samples T Test, ANOVA, Tukey Post Hoc
Taşçı Ağaoğlu & Durmaz (2021)	Article	Quantitative / Survey Model	5th, 6th, 7th, 8th grade	Digital Literacy Scale	128	Independent Samples T Test

Şahin & Sarıçam (2022)	Article	Quantitative	5th, 6th, 7th, 8th grade	Digital Literacy Scale, School Engagement Scale, Attitude Towards Reading Scale Personal Information Form	303	Pearson Product-Moment Correlation Analysis, Simple Linear Regression Analysis, Independent Samples T Test, ANOVA, LSD Post Hoc
Maden et al. (2018)	Article	Qualitative	5th grade	Document Analysis	5th Grade Turkish course books	Content analysis
Gür et al. (2021)	Article	Quantitative /Exploratory research	5th, 6th, 7th, 8th grade	Attitude Scale Towards Digital Technology	212	Exploratory Factor Analysis, normality test, reliability test, Independent Samples T Test, ANOVA
Görmez & Şen (2021)	Article	Qualitative /Descriptive	7th, 8th grade	Structured Interview Form	12	Content analysis
Direkçi et al. (2019)	Article	Qualitative /Descriptive	5th, 6th, 7th, 8th grade	Document Analysis	5th, 6th, 7th and 8th grade Turkish course books	Content analysis
Demirel & Çaydere (2023)	Article	Literature review / Traditional	5th, 6th, 7th, 8th grade	Literature review / Traditional	Visual Arts Lesson for 5th, 6th, 7th, 8th Grade	-

Table 2

Descriptive Information About the Studies of Articles

Study	Study Subject	Impact/Result
Banaz (2024)	Examining the 2024 Türkiye Century Maarif Model Secondary School Turkish Course Curriculum in Terms of Digital Literacy	It has been determined that the program was prepared with the concepts of digital reading and writing, technology, and the needs of the age in mind.
Berkay & Hazar (2024)	Digital Literacy in Primary School: Scale Development and Application	It was concluded that primary school students see themselves as sufficiently digitally literate.
Bayzan et al. (2023)	A Study on the Internet Usage Habits and Digital Literacy Skills of Children in Türkiye	The majority of children are not at the desired level in creative skills, such as producing positive content on the internet; they consume rather than produce. The majority of children lack the skills to protect their privacy online.
Duran & Ertan Özen (2018)	Digital Literacy in Turkish Lessons	It has been stated that digital literacy is included, and this skill is acquired through traditional methods.
Erdoğan (2021)	Digital Literacy and Cyberbullying: A Correlational Survey of Secondary School Students	When the research results were evaluated in terms of the dependent variable of cyberbullying, it was found that the average cyberbullying scores of the students changed significantly according to the variables of father and mother education status, and there was no difference in terms of the variables of gender, personal computer ownership and daily internet usage time.
Özaydın & Kumral (2021)	Digital Literacy Through the Eyes of Digital Natives	Participants consider themselves competent in using digital tools. They mostly use digital resources for education, playing games, having fun, watching videos, and communicating.
Şahin et al. (2022)	Development of a Digital Literacy Scale for Primary School Students: A Validity and Reliability Study	It is concluded that 6 of the data points from the digital literacy scale for primary school students have a perfect fit, and 3 have a good fit.

Study	Study Subject	Impact/Result
Aydemir et al. (2019)	Development of a digital literacy skills rubric	A valid and reliable measurement tool
Üstündağ (2021)	Examining the digital literacy levels of secondary school students during the COVID 19 pandemic	Children's digital literacy is at a medium level, with girls demonstrating a higher level.
Taşçı Ağaoğlu & Durmaz (2021)	An examination of middle school students' social media usage and digital literacy in terms of different variables	The level of digital literacy was higher in private schools compared to public schools.
Şahin & Sarıçam (2022)	Examining the relationships between attitudes towards reading, digital literacy and school engagement	There is a low-level positive correlation between reading attitude and digital literacy, reading attitude and school engagement, and digital literacy and school engagement. Attitude towards reading and digital literacy scores explain 10% of school engagement.
Maden et al. (2018)	Evaluation of 5th-grade secondary school Turkish course books in the context of digital literacy	It can be said that 5th-grade Turkish textbooks include instructions, text content, and various activities on reading and writing skills in digital environments; therefore, digital literacy, or reading and writing skills in media, is given importance in the textbook.
Gür et al. (2021)	A field study on the digital transformation awareness of secondary school students in the digital age	As students embrace digital transformation, their interest in technology increases. As students advance through the grades, their awareness of digital transformation grows.
Görmez & Şen (2021)	Middle school students' views on digital literacy skills	It has been determined that the majority of students use computers and mobile phones to access information; prefer secure sites to access information; verify the reliability of the information obtained by comparing it with different sites; pay attention to whether the sites they visit have security approval; and the most common activity they do using digital technology is to create Power Point (ppt). In general, it has been observed that middle school students who have taken social studies courses possess knowledge of the competencies that constitute digital literacy.
Direkçi et al. (2019)	Analyzing Turkish Course Curriculum (2018) and secondary school Turkish course books in the context of digital literacy skills	While the activities in the 5th, 6th, and 7th grades were deemed sufficient in terms of quantity, the 8th-grade Turkish textbook was found to be deficient in this regard.
Demirel & Çaydere (2023)	Digital literacy and the flipped learning model in art education	Revealing the possible contributions of the Flipped Learning model to the Visual Arts course and presenting course-specific, developable content.

Tables 1 and 2 above present the descriptive characteristics of the articles included in the study. Tables 3 and 4 present the descriptive characteristics of the theses. The descriptive characteristics of the theses included in the study are presented under the following headings: subject of study, research model, method, applied method, technical strategy/measurement tool, sample, data analysis method, and impact/results.

Table 3

Descriptive Information About the Thesis

Study	Publication Type	Design/Research Method	Class/School Level	Applied Method Technique Strategy/Measurement Tool	Sample /N	Data Analysis Method
Zurnacı Parlak (2019)	Thesis	Qualitative /Case study	5th, 6th, 7th, 8th grade	Goal-Based Scenario, Digital Literacy Scale, Critical Digital Literacy Observation Form, Semi-Structured Interview Form	24	Pearson Correlation Analysis, Dependent Sample T Test
Vural (2022)	Thesis	Quantitative /Causal-Comparative Research	5th, 6th, 7th, 8th grade	Digital Literacy Scale, Online Privacy Awareness Scale, Cyber Security Awareness Scale	1480	Linear and Multiple Regression Analysis, ANOVA, Correlation Analysis
İpek Süslü (2022)	Thesis	Quantitative	6th, 7th, 8th grade	Scale Development	659	Exploratory Factor Analysis

Study	Publication Type	Design/Research Method	Class/School Level	Applied Method Technique Strategy/Measurement Tool	Sample /N	Data Analysis Method
Nerse (2021)	Thesis	Quantitative /Quasi-experimental design	6th Grade	Force and Movement Academic Achievement Test, Metacognitive Awareness Scale for Children, Digital Literacy Scale Self-Learning Scale with Technology for Children	58	Two-Way Analysis of Variance for Repeated Measures, t-Test for Unrelated Samples, t-Test for Related Samples, Mann-Whitney U Test and Wilcoxon Signed Rank Test
Metin (2022)	Thesis	Quantitative /Descriptive /Relational screening design	5th, 6th, 7th, 8th grade	Personal Information Form, 'Digital Literacy Scale Learning Styles Scale for Primary School Students	640	Mann-Whitney U Test, Kruskal-Wallis
Laçin (2021)	Thesis	Quantitative /Quasi-experimental design	7th grade	Strength and Energy Academic Achievement Test, Self-Learning Scale with Technology for Children, Motivation Scale for Learning Science For Secondary School Students, Digital Literacy Scale	42	Two-Way Analysis of Variance
Kök (2024)	Thesis	Mixed Method/ Explanatory Sequential Design	6th Grade	Harezmi Education Model Lesson processing Mathematics Literacy Perception Scale, Universal Science Literacy Test Digital Literacy Scale Semi-Structured Interview Form	50	Dependent Group T Test, Independent Group T Test
Çelik (2021)	Thesis	Quantitative	5th, 6th, 7th grade	Personal Information Form Pala (2019), Digital Literacy Scale	632	Mann-Whitney U test and Kruskal-Wallis H Test
Kasap (2022)	Thesis	Quantitative /Quasi-experimental design	3rd Grade	Science Attitude Scale, Digital Literacy Scale for 10-12 Age Group Students, Critical Thinking Disposition Scale for Primary School Students	35	Shapiro-Wilk Test, Mann-Whitney U
Kartal (2024)	Thesis	Quantitative /Causal-Comparative Research	7th grade	Digital Literacy Scale Digital Technology Attitude Scale	931	t-Test for Independent Samples, ANOVA, Pearson Correlation Analysis, Predictive Regression Analysis
Kaptan (2022)	Thesis	Quantitative /experimental method	6th Grade	21st Century Skills Scale for Secondary School Students, Achievement Test Digital Literacy Scale for Students Ages 10-12	78	ANOVA
Gürbüz (2023)	Thesis	Quantitative /Quasi-experimental design	5th grade	Diffusion of Light Science Achievement Test (DLSAT), Critical Thinking Power of Secondary School 6th, 7th and 8th Grade Students in Science Lessons 10-12 Year Old Digital Literacy Scale	54	Dependent Group T Test, Independent Group T Test, ANCOVA
Gümüş (2023)	Thesis	Quantitative /Quasi-experimental design	7th grade	Personal Information Form Reading Comprehension Skills Test Digital Literacy Scale Semi-Structured Interview Form	61	Dependent Group T Test, Pearson correlation analysis; Pearson

Study	Publication Type	Design/Research Method	Class/School Level	Applied Method Technique Strategy/Measurement Tool	Sample /N	Data Analysis Method
						chi-square test, Fisher-Freeman-Halton exact test, Fisher's exact test
Gülmez (2024)	Thesis	Qualitative /Action Research	7th grade	Video/Audio Recording Document Analysis	26	Content analysis
Gönen (2024)	Thesis	Quantitative /Descriptive	5th, 6th, 7th, 8th grade	Digital Literacy Scale, Middle school students' perceptions of moral values in digital environments scale Cyberbullying Scale	553	independent sample t-test, One-Way ANOVA, correlation test and regression analysis
Ekemen (2024)	Thesis	Embedded mix Method design	6th Grade	Scale of Social Network Usage Purposes, "Digital Literacy Scale, Critical Thinking Scales, Social Media Tools Usage Status Survey Semi-Structured Interview Form	18	Mann-Whitney Whitney-U Test Wilcoxon Signed Rank Test Histogram Graphs, Content analysis.
Durmuş (2024)	Thesis	Quantitative /Quasi-experimental design	4th Grade	Digital Literacy Scale Scale for Evaluating Creative Writing Products student and teacher interview forms, researcher diaries	33	Independent samples t-Test
Koç (2023)	Thesis	Quantitative /Quasi-experimental design	7th grade	Achievement test Digital Literacy Scale	52	Dependent Group T Test, Independent Group T Test
Bucak (2023)	Thesis	Quantitative /Quasi-experimental design	7th grade	Digital Literacy Scale Achievement test Semi-Structured Interview Form	32	Independent samples t-test and paired (related) groups t-test
Aydoğdu (2022)	Thesis	Quantitative / Survey Model	5th, 6th, 7th grade	Digital Literacy Scale	268	Normality tests, t-test for independent groups, one-way Anova, Tukey, LSD tests
Aşcı (2024)	Thesis	Quantitative /Quasi-experimental design	7th grade	Personal Information Form Grammar Achievement Test, "Reading Comprehension Achievement Test", "Listening Comprehension Achievement Test", "Speaking Skills Rubric", "Writing Skills Rubric", Semi-Structured Interview Form Digital Literacy Scale	67	"Unrelated sample t-test", "related sample t-test", "Mann-Whitney U test" and "Wilcoxon signed-rank test, Content analysis

The descriptive characteristics of the theses included in the study are presented below. The research topics and impact/outcome information obtained from the included studies are presented in Table 4 below.

Table 4

Descriptive Information About the Thesis

Study	Study Subject	Impact/Result
Zurnacı Parlak (2019)	Providing digital literacy skills with goal-based scenarios	It has been concluded that students who are disadvantaged in terms of access to information and communication technologies can increase their digital literacy with the right pedagogical guidance without the need for a large number of computers.
Vural (2022)	Examining the characteristics of middle school students, such as cybersecurity awareness, online privacy awareness, digital literacy, and online gaming habits and the relationships between these variables.	A significant and positive relationship was found between cybersecurity awareness and digital literacy. It was concluded that there was also a significant and positive relationship between cybersecurity awareness and online privacy awareness. According to the research results, middle school students' cybersecurity awareness in online games was strong.
İpek Süslü (2022)	Developing a scale with tested validity and reliability to measure digital literacy self-efficacy levels of secondary school students.	It was concluded that the digital literacy self-efficacy scale was valid and reliable.
Nerse (2021)	Examining the effects of a problem-based learning approach enriched with Web 2.0 tools in the online education process on students' academic success, metacognitive awareness, self-learning with technology and digital literacy.	It was concluded that the enriched online PBL approach has a higher impact on academic achievement, metacognitive awareness, digital literacy and self-directed learning with technology.
Metin (2022)	Determining the relationship between digital literacy levels and learning styles of secondary school students	In the study, a weak positive relationship was found between the digital literacy levels of secondary school students and visual and tactile learning styles, and a moderate positive relationship was found between auditory and kinesthetic learning styles.
Laçin (2021)	Investigating the effects of e-learning processes supported by ClassDojo in science courses on the academic success, motivation towards science, digital literacy and self-learning with technology of 7th-grade students.	While e-learning activities supported by Classdojo in the experimental group showed a significant difference in students' academic achievement, no significant differences were found in motivation for learning science, digital literacy, or self-learning skills with technology.
Kök (2024)	Examining the effects of the Harezmi Education Model implemented in our country on three of the key competencies required for lifelong learning.	It has been determined that the Khwarezmi Education Model contributes to science, mathematics and digital literacy competencies.
Çelik (2021)	To examine the digital literacy skills of secondary school students in terms of various variables.	As a result of the analysis of the obtained data, it was determined that the Digital Literacy Scale scores of the students differed significantly according to gender, grade level, mother's education status, father's education status, internet connection at home, computer or tablet at home, family income status, and frequency of connection to the internet. No significant differences were found in the data obtained from the Digital Literacy Scale across the number of siblings, mother's occupation, father's occupation, and internet usage purposes.
Kasap (2022)	The effects of using digital stories in science education on students' attitudes towards science lessons, digital literacy levels and critical thinking skills.	According to the research results, the use of digital stories in science class positively affects attitudes towards science, digital literacy, and a tendency towards critical thinking.
Kartal (2024)	To determine the relationship between students' digital literacy and their attitudes towards digital technologies.	The analysis concluded that digital literacy significantly predicted attitudes towards digital technology.
Kaptan (2022)	The effects of using digital stories in information technologies and software courses on digital literacy, 21st-century skills, academic success and retention.	It was determined that collaborative digital storytelling activities had a strong impact on students' academic achievement but did not significantly affect retention, 21st-century skills, or digital literacy.

Study	Study Subject	Impact/Result
Gürbüz (2023)	The effects of digital story applications prepared with the 5E model on achievement, critical thinking and digital literacy skills	It was determined that the applications made in the experimental and control groups were effective.
Gümüş (2023)	The effect of digital storytelling on reading comprehension and digital literacy skills of middle school students	While a significant increase in reading comprehension was observed in the experimental group, no significant increase was observed in the control group, which processed the texts according to the regular Turkish lesson plan. A significant difference was observed in the digital literacy skills of the students in the experimental group, but none in the control group.
Gülmez (2024)	An action research to develop digital citizenship and digital literacy skills of 7th-grade secondary school students	As a result of the research activities, students' digital literacy and digital citizenship skills improved.
Gönen (2024)	Middle school students' digital literacy, perception of moral values in digital environments and cyberbullying levels	It has been determined that the variables of perception of moral values in digital environment and cyberbullying together have a low-level significant relationship with digital literacy; that the variables of digital literacy and cyberbullying together have a moderate-level significant relationship with perception of moral values in digital environment; and that the variables of digital literacy and perception of moral values in digital environment together have a moderate-level significant relationship with cyberbullying.
Ekemen (2024)	Examining the effects of social media-supported science education enriched with Web 2.0 tools on 6th-grade students' social media usage, digital literacy levels and critical thinking skills.	It was observed to have a positive effect on students' digital literacy and critical thinking skills. However, no significant difference was found.
Durmuş (2024)	The effects of collaborative digital literacy activities on students' creative writing and digital literacy skills.	It was determined that there was a significant difference in the pre-post tests of the experimental group students, and that the post-test scores of the experimental and control group students differed significantly in favor of the experimental group. In the qualitative dimension, it was determined that interest, motivation, and curiosity in the Turkish course increased through collaborative digital literacy activities, and that creative writing and digital literacy skills developed.
Koç (2023)	The effect of using the SAMR model in the force and energy unit on the academic success and digital literacy levels of 7th-grade students.	It was observed that there was a statistically significant difference in students' digital literacy skills, consistent with the plan prepared using Web 2.0 applications in the Science course teaching process.
Bucak (2023)	The effect of using Web 2.0 tools in social studies courses on students' academic success and digital literacy skills.	It can be said that the use of Web 2.0 applications in secondary school social studies courses positively affects both course success and students' digital literacy.
Aydoğdu (2022)	Examining the digital literacy levels of secondary school students	It has been determined that the digital literacy levels of secondary school students are above the median score in all dimensions, that the digital literacy levels decrease as the number of siblings increases, and that the digital literacy levels of those whose mothers are professionals, those who connect to the internet more frequently, and those living in the central district increase.
Aşcı (2024)	The effect of an authentic learning method on secondary school students' Turkish course success and digital literacy skills.	As a result of the quantitative analyses, it was concluded that the authentic learning method was effective in developing the digital literacy, reading comprehension, listening comprehension, speaking, writing, and grammar skills of the experimental group students and in ensuring permanent learning.

Findings Regarding the Subject of the Studies

When the studies were examined, 18 studies were identified that examined the effects of digital literacy on attitudes towards reading, learning styles, cyberbullying, internet and social media use, and digital storytelling. Then, it was determined that 5 studies aimed to develop digital literacy skills, and 4 studies aimed to develop digital literacy scales. It was determined that the other examined studies were curriculum reviews, Turkish textbook reviews, opinions on digital literacy, and level determinations.

Findings Regarding the Design/Research Method of the Studies

The research model in the studies' articles was determined as screening (qualitative/quantitative), case study, or document analysis. In the theses, the research model was designed as quantitative (quasi-

experimental, descriptive screening), mixed, and qualitative (action research, descriptive, document analysis). It was determined that 26 studies were quasi-experimental or screening studies in a quantitative design, and 8 were qualitative. It was determined that one of these was action research, two were case studies, and the others were descriptive studies. Two studies used a mixed-methods design, and one was a literature review.

Findings Related to the Method/Technique/Strategy/Measurement Tool Applied in the Studies

In the articles, document review, interview form, scale use or development were used as measurement tools. In the theses, scale use or development, interview forms and document analysis were used as measurement tools. It was observed that content analysis and SPSS-based analyses were used as analytical methods in the articles. In the theses, content analysis and SPSS-based analyses were used. When all studies were examined, it was determined that the “Digital Literacy Scale” was used in 22 studies, scale development was used in 4 studies, document review was done in 3 studies, interview form was used in 7 studies, personal information form was used in 6 studies and different scales were used in other studies. These scales; “Cyberbullying Scale”, “School Engagement Scale”, “Online Privacy Awareness Scale”, “Metacognitive Awareness Scale”, “Critical Digital Literacy Scale”, “Attitude Towards Reading Scale”, “School Engagement Scale”, “Self-directed Learning Scale”, “Self-directed Learning with Technology for Children Scale”, “Creative Writing Products Evaluation Scale”, “Mathematical Literacy Scale” and “Learning Styles Scale” were found. In addition, it was determined that the academic achievement test was used in 4 studies, and the “Reading Comprehension Skills Test” was used in 1 study.

Findings Regarding the Sample of the Studies

It was determined that 26 studies used a quasi-experimental design within the scope of the research. It was determined that each study included at least 32 participants. The study included 10,475 students and used a quantitative screening design, making it the largest study to date. It was determined that at least 6 people were studied in the qualitative, holistic case study and at least 18 participants were studied in the study designed as a mixed-nested design.

Findings Regarding the Data Analysis Method

Upon reviewing the data analysis methods employed in the studies examined for this research, it was noted that both content analysis and SPSS-based analyses were utilized across the articles and theses. The findings revealed the use of both descriptive and inferential analysis methods in these studies. Specifically, in the studies employing descriptive analysis, content analysis was applied in six cases. The inferential analysis methods most commonly used included the "Independent sample t-test," "ANOVA," "Mann-Whitney U test," "Wilcoxon signed-rank test," "correlation test," and "regression analysis”.

Findings Regarding Impact/Result

Based on the descriptive analysis of the studies included in this research, it was determined that the program was developed with a strong emphasis on digital literacy. Content analysis of the program and textbooks revealed that digital literacy was prominently featured. Interview data indicated that students felt competent in this area. When measuring digital literacy levels, participants generally exhibited medium to good proficiency, and significant progress was observed in studies focused on developing digital literacy skills. Additionally, valid and reliable measurement tools were created in scale development studies. In semi-experimental studies analyzed using inferential statistical methods, it was found that digital literacy skills significantly improved in predicted contexts, including cybersecurity awareness, learning styles, digital storytelling, attitudes toward digital technology, and critical thinking skills. However, in three studies aimed at developing and measuring digital literacy (Bayzan et al., 2023; Kaptan, 2022; Laçin, 2021), no significant differences were observed, and many children lacked sufficient digital literacy skills.

Discussion

This study systematically reviewed digital literacy research conducted in Türkiye at the primary and secondary school levels, encompassing 21 theses and 16 journal articles. Beyond mapping the distribution of studies, the findings reveal important structural, methodological, and conceptual tendencies that characterize the national research landscape and highlight critical gaps relative to international scholarship.

One of the most salient findings is that digital literacy research in Türkiye predominantly focuses on measuring, predicting, or describing levels of digital literacy. At the same time, comparatively few studies aim to design, implement, or evaluate interventions intended to foster digital literacy skills. Although this descriptive emphasis is consistent with earlier national reviews (Bahşi & Ateş, 2024; Özkaya & Erat, 2022; Yeşiltaş et al., 2022), it contrasts with international trends where digital literacy is increasingly examined as a pedagogical and developmental construct, embedded within instructional design, curriculum innovation, and classroom practices (Ng, 2012; OECD, 2021; Spante et al., 2018). From this perspective, the limited number of skill-oriented and practice-based studies in Türkiye suggests that digital literacy is still largely conceptualized as an outcome to be assessed rather than a competence to be systematically cultivated.

The temporal distribution of the reviewed studies indicates a growing scholarly interest in digital literacy over the past few years. This increase parallels global developments driven by rapid digitalization, the expansion of online learning environments, and heightened concerns regarding students' digital competencies (European Commission, 2020; UNESCO, 2018). However, despite this quantitative growth, the studies' thematic focus remains relatively narrow. Articles tend to concentrate on curriculum analyses, scale development, and level determination, whereas theses more frequently address awareness, skill levels, and academic outcomes. While this differentiation reflects the methodological scope of graduate research, it also suggests that theoretical diversification and cross-contextual analysis remain limited.

Methodologically, the dominance of quantitative designs, particularly survey-based screening models, aligns with the findings of Özkaya and Erat (2022) and Yeşiltaş et al. (2023). Although quantitative approaches are valuable for identifying general trends, the relative scarcity of qualitative and mixed-method studies constrains deeper insight into how students experience digital literacy, how teachers interpret curricular expectations, and how digital competencies are enacted in real classroom settings. International studies increasingly emphasize mixed and qualitative approaches to capture the contextual, social, and critical dimensions of digital literacy (Buckingham, 2015; Hatlevik & Christophersen, 2013). In this regard, the present study contributes to the literature by explicitly identifying methodological patterns and highlighting the need for greater methodological plurality.

An important contribution of this research lies in its analysis of grade-level distribution and sample selection. The findings demonstrate a strong concentration on secondary school students, with relatively limited attention to primary school learners. This imbalance is notable given international consensus that digital literacy development should begin at early ages and progress cumulatively across schooling levels (Fraillon et al., 2019; UNESCO, 2018). Moreover, the absence of teachers and parents as primary sample groups represents a significant gap. While Yeşiltaş et al. (2023) reported a predominance of teacher candidates in digital literacy research, the current study shows that research at the compulsory education level remains limited, thereby reinforcing the need for more inclusive stakeholder perspectives.

Regarding measurement tools and data analysis, the frequent use of scales, interviews, and document analysis reflects common practices in the field. However, unlike previous national reviews (Bahşi & Ateş, 2024; Özkaya & Erat, 2022), this study explicitly documents the use of content analysis and SPSS-based statistical techniques, thereby offering a more systematic account of analytical procedures. This distinction strengthens the methodological transparency of the review and provides a clearer roadmap for future researchers.

Conclusion

Finally, the findings regarding research outcomes indicate that digital literacy is increasingly reflected in curricula and textbooks, that students generally perceive themselves as moderately to highly digitally literate, and that intervention-based studies report positive developmental effects. However, the reliance on self-reported perceptions raises concerns regarding the alignment between perceived and actual digital competencies, a discrepancy widely noted in international research (Fraillon et al., 2019; OECD, 2021). Therefore, future studies should incorporate performance-based assessments and longitudinal designs to better capture developmental trajectories.

In conclusion, although the scope of this review is limited to 37 studies conducted in Türkiye and does not include international publications, this constraint has enabled a focused, context-specific, and in-depth

analysis of primary and secondary level research. Rather than weakening the discussion, this bounded scope allows for clearer identification of national research priorities and deficiencies. Future research would benefit from (a) expanding sample diversity to include teachers and parents, (b) adopting experimental and mixed-method designs, and (c) conducting comparative studies that situate Türkiye within broader international digital literacy frameworks. In this respect, the present study not only synthesizes existing findings but also provides a conceptual and methodological guide for advancing digital literacy research in compulsory education.

Author's Note

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CRediT authorship contribution statement

Z. E. Ketenoğlu Kayabaşı: Literature search (equal); methodology (lead); formal analysis (lead); visualization using data to create charts, graphs or figures; writing – review and editing (equal).

E. Karasu Avcı: Conceptualization (lead); literature search (equal); writing – review and editing (equal); specifically writing the initial draft (including substantive translation).

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics Approval and Consent to Participate

The present study was conducted using a descriptive approach within a descriptive survey design. The study examined only publicly available theses and articles. No data was collected directly from human or animal participants. Consequently, ethics committee approval is not a prerequisite. All data utilized in the study were obtained from open-access sources, and ethical principles were adhered to throughout the research process.

Declaration of AI Usage Statement

The authors affirm that no AI tools were employed in the preparation of this article.

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| Systematic Review / Sistematik Derleme |

A Systematic Review of Doctoral Dissertations on Turkish Language Teaching in Primary Education

Sınıf Eğitimi Alanında Türkçe Öğretimine İlişkin Doktora Tezlerine Sistematik Bir Bakış

Fisun Güngör Yereyıkılmaz[1]

Keywords

Doctoral dissertation

Primary education

Systematic review

Turkish language teaching

Abstract

This study aims to systematically examine doctoral dissertations focused on the teaching of Turkish language in primary education from bibliometric, methodological, findings, and recommendation perspectives. The study adopted a systematic review methodology and was conducted in accordance with the PRISMA 2020 guidelines. Within this framework, a search was performed in the National Thesis Center of the Council of Higher Education (YÖKTEZ) database using the keywords "primary education," "elementary education," "classroom education", "teaching Turkish language" and "Turkish education". The search was limited to the years 2022–2025 in order to reveal current research trends. A total of 486 doctoral dissertations were identified, and 57 dissertations were included in the study based on predefined inclusion criteria, namely being conducted in the context of primary education and directly addressing Turkish language teaching. The dissertations were analyzed through descriptive content analysis. The findings indicate that doctoral dissertations are bibliometrically concentrated in a limited number of universities and that dissertation production peaked in 2022. Methodologically, most studies were descriptive in nature and primarily aimed to portray the current state of affairs, with quantitative and mixed-method designs being predominantly preferred. Thematically, the development of reading and writing skills, critical writing, digital literacy, and technology-supported instructional practices were prominent, whereas studies focusing on listening and speaking skills remained limited. The findings obtained from the reviewed research were categorized under the themes of cognitive and academic development, affective and participatory development, and methodological and pedagogical innovations. Overall, the reviewed studies emphasize reading and writing development, student-centered approaches, and higher-order thinking skills, while highlighting the need for more practice-based, long-term, and holistic instructional models in Turkish language teaching.

Anahtar Sözcükler

Doktora tezi

Sınıf eğitimi

Sistematik derleme

Türkçe öğretimi

Öz

Bu çalışma, sınıf öğretmenliği alanında Türkçe öğretimi üzerine gerçekleştirilen doktora tezlerinde ortaya çıkan eğilimleri, bibliyometrik, yöntemsel, tematik, sonuç ve öneri boyutları açısından sistematik olarak incelemeyi hedeflemektedir. Çalışmada sistematik derleme yöntemi benimsenmiş ve araştırma PRISMA 2020 yönergelerine uygun olarak gerçekleştirilmiştir. Bu kapsamda YÖK Ulusal Tez Merkezi (YÖKTEZ) veri tabanında "ilköğretim", "temel eğitim", "sınıf eğitimi", "Türkçe öğretimi" ve "Türkçe eğitimi" anahtar kelimeleri kullanılarak tarama yapılmıştır. Güncel eğilimleri ortaya koymak amacıyla tarama 2022–2025 yılları ile sınırlandırılmıştır. Tarama sonucunda toplam 486 doktora tezine ulaşılmış; önceden belirlenen dâhil etme ölçütleri doğrultusunda, ilkokul bağlamında yürütülen ve doğrudan Türkçe öğretimini konu alan 57 doktora tezi çalışma kapsamına alınmıştır. Çalışma kapsamındaki tezler betimsel içerik analizi ile incelenmiştir. Tezlerin bibliyometrik olarak büyük oranda birkaç merkezde yoğunlaştığı ve 2022 yılında üretimin zirve yaptığı belirlenmiştir. Bulgular, doktora tezlerinin bibliyometrik olarak sınırlı sayıda üniversitede yoğunlaştığını ve tez üretiminin 2022 yılında zirveye ulaştığını göstermektedir. Yöntemsel açıdan, araştırmaların büyük çoğunluğunun mevcut durumu betimlemeye yönelik olduğu, nicel ve karma yöntem desenlerinin ağırlıklı olarak tercih edildiği belirlenmiştir. Tematik açıdan, okuma ve yazma becerilerinin geliştirilmesi, eleştirel yazma, dijital okuryazarlık ve teknoloji destekli öğretim uygulamaları öne çıkarken; dinleme ve konuşma becerilerine odaklanan çalışmaların sınırlı olduğu görülmüştür. İncelenen araştırmalardan elde edilen bulgular; bilişsel ve akademik gelişim, duyuşsal ve katılımsal gelişim ile yöntemsel ve pedagojik yenilikler temaları altında toplanmıştır. Genel olarak değerlendirildiğinde, incelenen çalışmaların okuma ve yazma becerilerinin geliştirilmesine, öğrenci merkezli yaklaşımlara ve üst düzey düşünme becerilerine vurgu yaptığı; buna karşılık Türkçe öğretiminde uygulamaya dayalı, uzun süreli ve bütüncül öğretim modellerine daha fazla ihtiyaç duyulduğu sonucuna ulaşılmıştır.

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Introduction

Primary education represents a critical period during which the foundations for children's linguistic, cognitive, and social development are established. The quality of instruction provided during these years directly influences students' subsequent learning, future academic success, social adjustment, and communication skills. In particular, fundamental 21st-century skills—such as critical thinking, problem-solving, collaboration, and communication—are rooted in the language and cognitive abilities acquired at this stage (UNESCO, 2020). Research shows that early investments in primary education yield long-term social and cognitive returns for individuals (Heckman, 2011; Liu et al., 2024).

Despite the recognized importance of primary education, the PISA (2013) report indicates that, globally, 250 million students who complete primary education fail to attain minimum proficiency in basic reading and writing skills (Cresswell et al., 2015). According to the PISA 2022 results, approximately 27% of students aged 15 demonstrate less than basic proficiency in reading (OECD, 2023). Similarly, the 2025 UNESCO Global Education Monitoring (GEM) Report shows that 60% of children completing primary school do not acquire fundamental literacy competencies (UNESCO, 2024). These findings reveal a globally concerning picture regarding the quality of primary education. PIRLS (Progress in International Reading Literacy Study) results provide a comparative assessment of fourth-grade students' reading skills, highlighting reading comprehension as the foundation for learning across all disciplines (Hillman et al., 2023). Such international assessments underscore the universal importance of foundational literacy skills acquired through mother-tongue instruction at the primary school level.

Within primary education, teaching Turkish is considered the subject area that most significantly affects students' intellectual development (Güneş, 2020). It not only focuses on teaching the language itself, but also serves as a cognitive tool that supports students' perception, comprehension, and communication with the world. With these characteristics, the Turkish course significantly influences students' critical thinking skills, creative writing abilities, emotional expression, and social success (Temizkan, 2010; Maden, 2010; Demir, 2013).

In addition to cognitive development, teaching Turkish language is a key educational tool supporting linguistic and affective growth (Çer, 2016; Genç, 2017). Listening skills—which are the most frequently used in daily life and form the basis for other language abilities—involve complex cognitive and affective processes, such as focusing attention, making sense of auditory input, and establishing empathy (Karadüz, 2010; Doğan, 2013). Conversely, speaking skills allow individuals to express themselves verbally and build social bonds (Saltalı & Erbay, 2013). Reading skills, which help students understand, relate to, and reflect on social realities—thus allowing for questioning and problem-solving—are a primary tool for critical thinking, organizing information, and developing higher-order cognitive functions (Erman-Aslanoğlu & Kutlu, 2015; Polat et al., 2024). Writing skills, which are essential not only for language learning but also for social life, are directly related to the cognitive structuring, planning, and creative expression of thoughts (Temizkan, 2010).

Doctoral education, which aims to elevate teacher competencies to the highest level, is considered one of the most critical stages in the field of teacher education. Doctoral education represents an advanced academic structure designed not only to enhance teachers' classroom-based pedagogical practices but also to deepen their engagement with theoretical knowledge production, research design, and scientific thinking processes. In this context, doctoral programs in the field of primary school teaching seek to enable teachers to move beyond their practitioner identities and assume the roles of researchers, curriculum developers, and academic leaders within the field.

The primary objective of the Anadolu University Primary School Teaching Doctoral Program is to equip students with advanced-level knowledge, skills, and professional dispositions, enabling specialization in the field and supporting scientific contributions through both theoretical and applied research (Anadolu University, 2024). Similarly, the Eskişehir Osmangazi University Primary School Teaching Doctoral Program aims to educate individuals who are capable of developing alternative solutions to existing educational challenges and generating original policies aligned with the country's social and cultural context (Osmangazi University, 2024). In this respect, doctoral education equips primary school teachers with an interdisciplinary

perspective, enhances their academic capacity to redesign educational environments, and fosters competencies necessary to guide national education systems on a scientific foundation.

Doctoral dissertations on Turkish language teaching within the field of primary education constitute a substantial academic accumulation. These dissertations address the multidimensional nature of Turkish language teaching, including instructional methods, material development, technology integration, and assessment and evaluation processes, thereby providing rich and in-depth insights into instructional practices (Özenç & Özenç, 2018). However, the absence of a systematic review approach that holistically examines these dissertations limits the clear identification of prevailing trends, strengths, and research gaps in doctoral-level knowledge production. This situation highlights the need for a critical evaluation of doctoral education in terms of research content, methodological orientations, and academic priorities.

In recent years, the significance of digital tools and technological approaches in teaching Turkish as a first language (L1) and as a second language (L2) has increased considerably. Digital storytelling, artificial intelligence–supported writing analysis, e-book applications, and digital portfolios have emerged as prominent contemporary practices in Turkish language teaching (Tepeli & Canlı, 2019). At the same time, Turkish language education is closely associated with broader dimensions such as cultural transmission, values education, and individual identity development (Demirkol & Boyacı, 2018). This underscores that doctoral-level research in Turkish language education carries not only academic significance but also social and pedagogical responsibility.

Turkish language education constitutes a substantial proportion of postgraduate theses conducted in the field of primary education. Recent studies have attracted attention due to their thematic diversity and methodological orientations. While Kesik and Ciğerci (2020) and Önal and Maden (2021) examined postgraduate theses in primary education from a general perspective, Coşkun et al. (2012), Boyacı and Demirkol (2018), and Turan et al. (2018) analyzed dissertations in Turkish language education across extended time spans. Additionally, several studies have focused on specific language skills within Turkish language teaching. Nevertheless, many of these studies are characterized by fragmented analytical frameworks and limited variables, which restrict their capacity to present the overall trends of doctoral education in a comprehensive manner.

Based on this gap, the present study aims to examine doctoral dissertations on Turkish language teaching in the field of primary education through a systematic review methodology. Within the scope of the study, dissertations were not merely classified descriptively; rather, they were analyzed within a multidimensional framework encompassing research purposes, methodological orientations, instructional approaches, theoretical foundations, findings, and recommendations. In doing so, the study makes visible the quality and orientation of scientific knowledge produced through doctoral education and provides a basis for the structural and content-based evaluation of doctoral programs.

In conclusion, this study is expected to make a significant contribution to the literature by revealing the current state of doctoral education in Turkish language teaching within primary education, identifying research trends and gaps, guiding future doctoral research, and informing the development of doctoral programs. The findings are anticipated to provide a scientific foundation for decision-makers involved in teacher education policies, doctoral program restructuring, and academic planning processes. Beyond enriching the existing body of knowledge, the study is projected to function as a strategic guide aimed at enhancing the overall quality of doctoral education in the field. The aim of this study is to systematically examine trends emerging in doctoral dissertations on Turkish language teaching in primary education through bibliometric, methodological, thematic, results, and recommendation dimensions. Within this framework, the study seeks to address the following research questions:

1. What are the quantitative trends in the bibliometric characteristics (year and university) of doctoral dissertations on Turkish language teaching within primary education?
2. What methodological trends are evident in terms of research purposes, research designs, participant characteristics, data collection instruments, and data analysis techniques employed in these dissertations?

3. What topics do these dissertations focus on regarding key language skills, types, sub-skills, and disciplines within Turkish teaching?
4. What key findings and recommendations are reported in these dissertations?

Method

This study employed a systematic review approach to examine doctoral dissertations on Turkish language teaching within the context of primary education. A systematic review is a research methodology that identifies existing studies on a given topic, selects relevant studies based on predefined inclusion criteria and quality evaluation procedures, and analyzes and synthesizes the included studies in a structured manner (Aslan, 2018; Snyder, 2019). Such reviews aim to provide a comprehensive, transparent, and unbiased synthesis of the research landscape through replicable procedures (Higgins et al., 2022).

The review process was conducted in accordance with the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which offer an evidence-based framework for documenting the identification, screening, eligibility, and inclusion stages of systematic reviews (Page et al., 2021). Adherence to PRISMA enhances transparency, methodological consistency, and reporting quality in evidence synthesis studies.

Given that the present study focuses on identifying research trends in doctoral-level work, the systematic review design enabled a comprehensive and integrative evaluation of postgraduate knowledge production in Turkish language teaching.

Methodologically, the review was guided by established evidence-synthesis models used in educational research. In line with Newman and Gough (2020), the process involved: developing the research question, designing the conceptual framework, constructing selection criteria, developing the search strategy, selecting studies using those criteria, conducting coding procedures, evaluating study quality, synthesizing findings, and reporting results. These stages ensured alignment with the epistemological and methodological characteristics of education-focused systematic reviews.

Additionally, the literature identification and selection procedures followed the four-step structure described by Gamage et al. (2022):

(1) identifying relevant literature,

(2) screening studies according to predetermined criteria,

(3) classifying the screened studies through systematic coding and thematic organization, and

(4) determining the studies to be included in the review.

In this study, these steps were implemented sequentially to ensure a transparent and replicable selection process. The workflow of identification, screening, and inclusion/exclusion was structured according to PRISMA 2020 standards. The database was searched on [April, 2025] using combinations of the keywords “primary education,” “elementary education,” “classroom education”, “teaching Turkish language” and “Turkish education”. The detailed study selection process is presented in Figure 1.

Figure 1

PRISMA 2020 Flow Diagram Illustrating the Identification, Screening, and Inclusion/Exclusion Process of the Dissertations Included in the Systematic Review

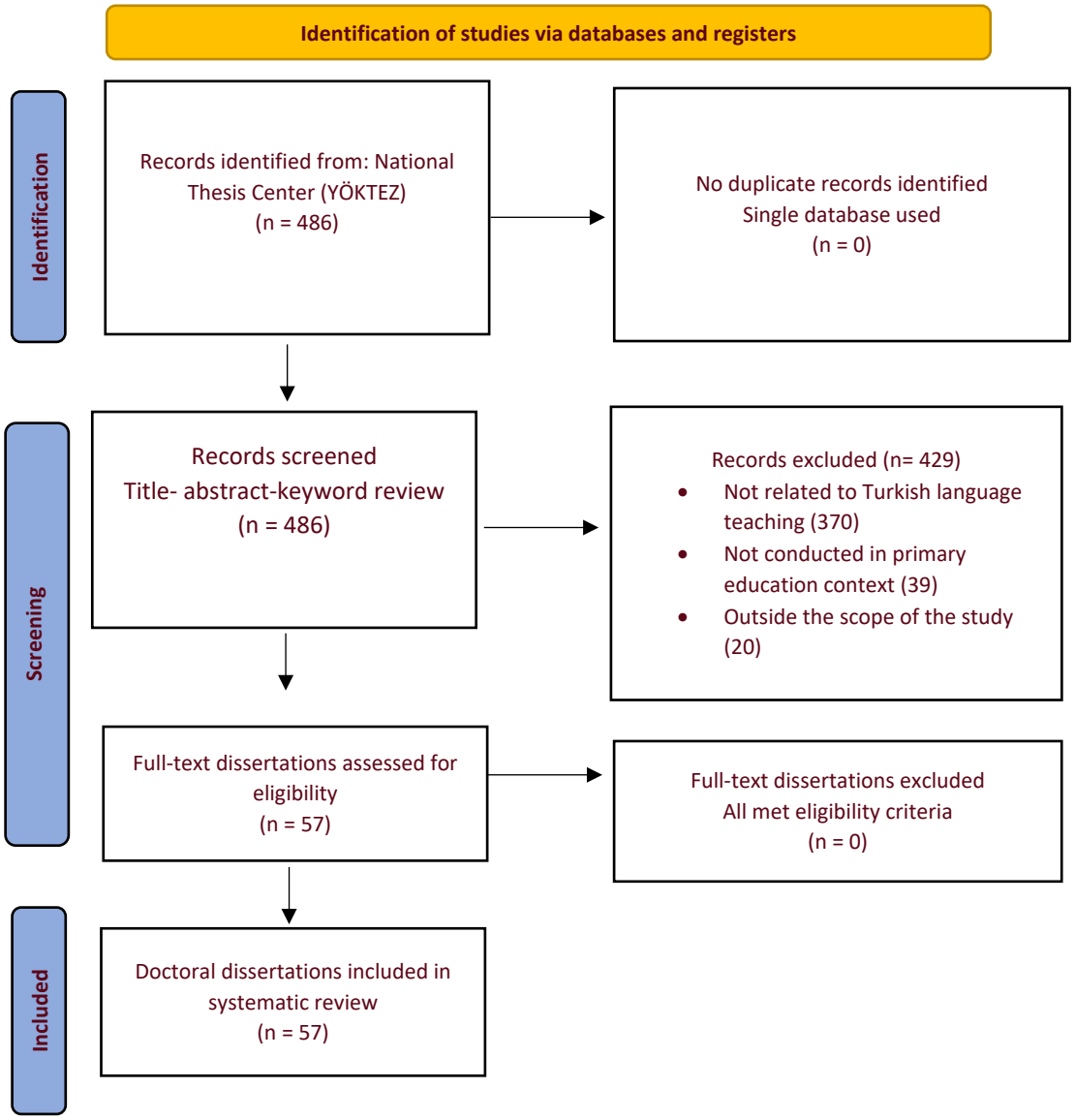


Figure 1 presents the PRISMA 2020 flow diagram illustrating the stages of identification, screening, eligibility assessment, and inclusion of the doctoral dissertations analyzed in this review. The diagram visually summarizes how the initial pool of studies obtained from the YÖKTEZ database was progressively narrowed based on predefined eligibility criteria. It demonstrates the transparency of the selection procedure by reporting the number of records retrieved, excluded with justification, and ultimately included in the synthesis.

In systematic reviews, clearly defined eligibility criteria are essential to minimize selection bias and ensure analytical consistency (Page et al., 2021). Accordingly, inclusion and exclusion criteria were determined prior to the screening process.

The screening and eligibility assessment were conducted by the researcher. A structured data extraction form was developed to systematically record the characteristics of each dissertation.

The study included dissertations that (a) were registered in the YÖKTEZ database, (b) were completed between 2022 and 2025, (c) were situated within the context of primary or classroom education, (d) directly addressed Turkish language teaching, and (e) provided accessible full texts for analysis.

Dissertations were excluded if they (a) were not related to Turkish language teaching, (b) were conducted outside the primary education context, (c) focused on different disciplinary areas, or (d) did not align with the purpose of the present review.

During the identification stage, 486 doctoral dissertations were retrieved from the YÖKTEZ database. Because the review relied on a single national database, no duplicate records were identified.

In the screening stage, all records were examined through title, abstract, and keyword review. A total of 429 dissertations were excluded for not meeting the scope of the study. These exclusions consisted of studies not related to Turkish language teaching (n = 370), studies not conducted within the primary education context (n = 39), and studies outside the conceptual focus of the review (n = 20).

At the eligibility stage, the remaining 57 dissertations were examined in full text to determine their relevance and methodological suitability. No studies were excluded at this stage because all remaining dissertations met the predefined criteria. Consequently, 57 dissertations were included in the final dataset for analysis.

Data Analysis

The doctoral dissertations examined in this study were analyzed according to the principles of descriptive content analysis. Descriptive content analysis is an analytical method in which qualitative and quantitative studies on a particular subject are systematically examined and classified to reveal general trends and patterns. This approach is grounded in core scientific principles such as objectivity, inter-rater reliability, validity, replicability, and generalizability (Neuendorf, 2002; Creswell, 2008). The data were coded in line with the sub-objectives of the research, with main themes, sub-themes, and codes identified. Bibliometric, methodological, and Turkish language education features and trends were quantitatively described using frequency and percentage calculations, which were presented in tables and figures to provide numerical support for the research. Trends related to the aims, findings, and methodologies of the dissertations were qualitatively described and presented using thematic maps and visualizations to add depth to the analysis. Accordingly, both qualitative themes and frequency/percentage distributions were included in the presentation of findings.

To ensure the validity and reliability of the study, data on the identified variables were independently reviewed by two researchers, and relevant information for each dissertation was recorded on a coding form. The information was cross-checked for accuracy, and any discrepancies or missing data were resolved by consensus. The final data were grouped and classified according to predetermined categories. The inter-coder agreement rate was determined to be 94% (Miles & Huberman, 1994).

Additionally, the aims, topics, findings, and recommendations sections of the dissertations were examined in detail using thematic content analysis. Each researcher independently coded the studies, analyzed representative statements, and generated themes based on the findings. The inter-coder agreement rates were calculated as follows: 98% for research aims, 95% for topics analyzed, 84% for findings, and 94% for recommendations (Miles & Huberman, 1994). Codes deemed irrelevant were excluded, similar codes were grouped into higher-order categories, and these categories were then organized under main themes, interpreted descriptively, and finalized.

Findings

The research findings were organized into five main themes: (1) bibliometric characteristics and trends, (2) methodological characteristics and trends, (3) focus areas and distributions in the teaching of Turkish within primary education, (4) prominent findings of the research, (5) prominent recommendation of the research. These main themes and their associated sub-themes were structured to clarify the most significant trends and content patterns identified in the study.

Bibliometric Characteristics and Trends

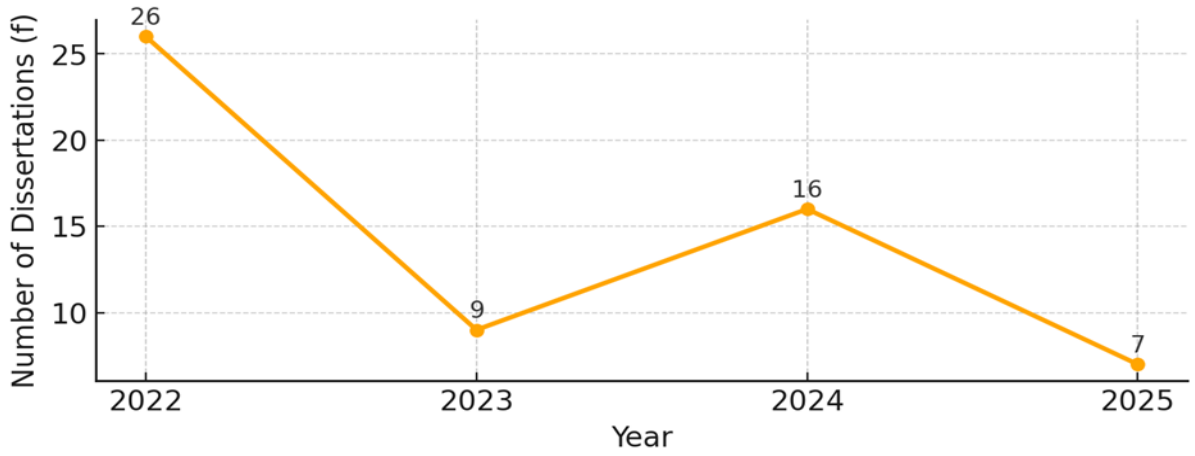
The bibliometric characteristics of the analyzed doctoral dissertations were examined under two sub-themes: “distribution by publication year” and “distribution by university,” which are detailed below.

Distribution by Year of Publication

This sub-theme presents the quantitative distribution of dissertations by year and reveals trends over time. Figure 2 displays the annual distribution of doctoral dissertations on the teaching of Turkish within primary education between 2022 and 2025.

Figure 2

Distribution of Doctoral Dissertations by Year



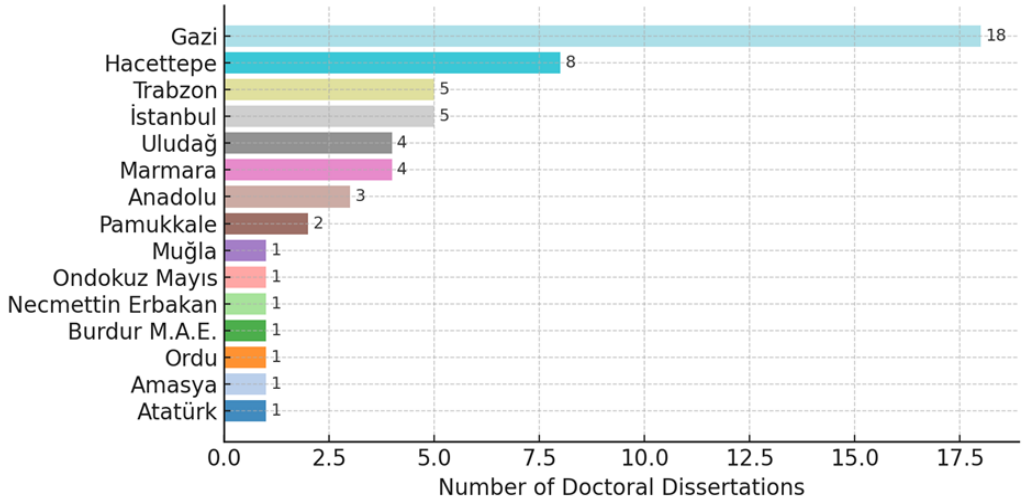
An examination of the graph shows that 2022 stands out as the year with by far the highest number of dissertations produced (f = 26). There is a significant decrease in the number of dissertations in 2023 (f = 9), but this decline is partially offset in 2024, when the numbers rise again (f = 16). In 2025, the number of dissertations decreases once more (f = 7); however, this decrease may be attributable to the fact that 2025 had not yet ended at the time of data collection.

Distribution by University

In higher education, the research productivity of universities is a crucial indicator for academic planning and policy development. Therefore, doctoral dissertations completed in the field of Turkish education, particularly within primary education in Türkiye, were analyzed by university, as illustrated in Figure 3.

Figure 3

Completed Doctoral Dissertations in the Field of Turkish for Primary School Teaching by University



The distribution of dissertations by university reveals a concentration of research production in specific institutions. Gazi University has produced the highest number of dissertations in the field of Turkish education, with a total of 18. Hacettepe University follows with 8 dissertations, while Trabzon and Istanbul universities each contribute 5. Uludağ University and Marmara University have moderately represented the field with 4 dissertations each. Most other universities have between 1 to 3 dissertations. These findings indicate that doctoral-level research activities are primarily concentrated in a few central universities, although regional contributions are also increasing.

Methodological Characteristics and Trends

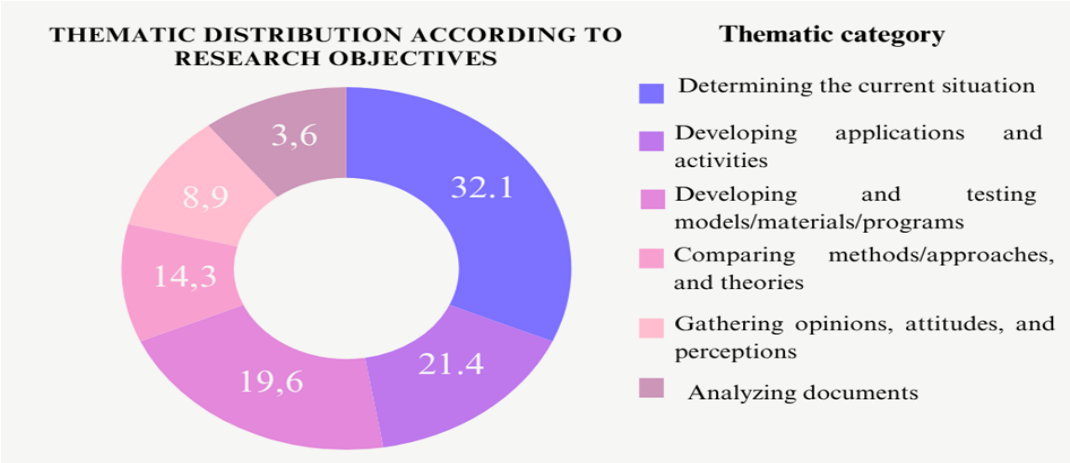
Under this main theme, the following sub-themes were identified and are explained below: “trends in research objectives”, “distribution of research methods and designs”, “distribution according to participant profiles”, “distribution of data collection tools”, and “distribution of data analysis methods”.

Trends in Research Objectives

To determine the direction and areas of contribution of the dissertations, their research objectives were analyzed and classified based on conceptual similarities, and the resulting themes are presented in Figure 4.

Figure 4

Thematic Distribution According to Research Objectives



When examining Figure 4, it is evident that the most prevalent category of research objectives is studies aimed at determining the current situation, which accounts for 32.1%. These dissertations focus on describing general trends in the field by collecting data on areas such as student competencies, teacher practices, or classroom effectiveness.

The second most common category, research aimed at developing applications and activities, represents 21.4% of the studies. This category emphasizes testing the integration of innovative practices, including new teaching methods, creative writing, digital tools, and drama applications into educational processes.

Dissertations that concentrate on model, material, and program development and testing make up 19.6% of the research. These are generally educational design-oriented studies conducted within an action research framework.

Studies focusing on the comparison of methods or approaches account for 14.3% and are often carried out using experimental research designs. Research aimed at gathering opinions, attitudes, and perceptions constitutes 8.9% and centers on understanding individuals' perspectives regarding educational processes. Finally, studies involving document analysis are relatively rare, comprising only 3.6%. This distribution indicates that educational research is primarily application-oriented and supported by innovative approaches.

Distribution of Research Methods and Designs

The research methods employed in doctoral dissertations on the teaching of in the field of primary education in Türkiye, as well as the types of research designs underlying these methods, are of critical importance for understanding methodological trends. In this context, the dissertations were analyzed according to method and design classification, and the results are presented in Table 1.

Table 1

Distribution of Research Methods and Designs

Method Type	Design Type	*f*	%
Quantitative	Pretest-posttest control group	22	37.9%
	Single group pretest-posttest	6	10.3%
	Causal-comparative / Correlational	3	5.2%
Total Quantitative		31	53.4%
Mixed	Convergent parallel design	9	15.5%
	Explanatory sequential design	7	12.1%
	Embedded design	3	5.2%
	Nested design	6	10.3%
Total Mixed		25	43.1%
Qualitative	Case study	8	15.5%
	Action research	6	10.3%
Total Qualitative		14	25.8%
Grand Total		**57**	**100%**

Based on Table 1, it can be seen that the most frequently preferred method among the 57 analyzed doctoral dissertations is the quantitative method (53.4%), with the pretest-posttest control group design (37.9%) standing out in particular. This indicates a high prevalence of empirical studies focused on measurable variables in the field. The use of mixed methods (43.1%) is also notable, with convergent parallel design (15.5%) and explanatory sequential design (12.1%) being the most commonly employed approaches. This suggests that researchers are increasingly adopting multidimensional data analysis. Qualitative methods (25.8%) are mainly represented by case studies (15.5%) and action research designs (10.3%), reflecting a trend toward more in-depth analysis of instructional processes.

Distribution according to Participant Profiles

The samples and study groups of the dissertations were analyzed and are presented in Table 2.

Table 2

Distribution of Participant Profiles

Participant Description	*f*	(%)
4th Grade Students and Teachers	19	33.3%
4th Grade Students	14	24.6%
3rd Grade Students	5	8.8%
2nd Grade Students and Teachers	4	7.0%
3rd Grade Students and Teachers	3	5.3%
2nd Grade Students	2	3.5%
1st Grade Students	2	3.5%
1st, 2nd, 3rd, and 4th Grade Students + Teachers + Parents + Administrators	1	1.8%
Other (Documents, programs, literary works)	7	12.3%
Total	**57**	**100.0%**

Based on Table 2, the most frequently selected participants in the doctoral dissertations were 4th grade students and their teachers (33.3%). Studies focusing solely on 4th grade students also represented a significant proportion (24.6%). Studies such as document analysis and meta-analyses, which do not include participants, were observed at a lower rate. The findings reveal a tendency to focus on upper grade groups and their teachers in research. Dissertations with a broad participant profile (1.8%), as well as those involving

different sample groups such as students with special needs, migrants, or pre-service teachers (12.3%), were quite limited.

Distribution of Data Collection Tools

In order to examine the distribution of data collection tools used in the dissertations, the studies were analyzed and the findings are presented in Table 3.

Table 3

Distribution of Data Collection Tools

Data Collection Tool	*f*	(%)
Semi-structured interview	22	20.6%
Observation form	14	13.1%
Focus group interview	8	7.5%
Researcher diary	5	4.7%
Document analysis	4	3.7%
Unstructured interview	2	1.9%
Video/activity observation	1	0.9%
Achievement test	19	17.8%
Questionnaire	11	10.3%
Rubric	8	7.5%
Performance assessment tool	5	4.7%
Standardized test	3	2.8%
Multiple-choice test	2	1.9%
Pre-test/post-test forms	2	1.9%
Likert scale forms	1	0.9%
Total	**107**	**100%**

According to Table 3, the most frequently used data collection tools in the dissertations were semi-structured interviews (20.6%) and achievement tests (17.8%). Semi-structured interviews were preferred for gaining an in-depth understanding of participant experiences, while achievement tests were used for objectively evaluating learning outcomes. Observation forms and researcher diaries provided detailed data on implementation processes, while rubrics and questionnaires were commonly employed for measuring performance and attitudes. These findings indicate an increase in methodological diversity and a growing preference for mixed methods in the field of primary education.

Distribution of Data Analysis Methods

The data analysis methods adopted in the dissertations are presented in Table 4.

Table 4

Distribution of Data Analysis Methods

Analysis Type	Sub-method	*f*	(%)
Quantitative	T-Test	22	39.3%
	SPSS-Based Analysis	16	28.6%
	ANOVA	12	21.4%
	Effect Size (Cohen's d)	8	14.3%
Qualitative	Descriptive Analysis	20	35.7%
	Content Analysis	15	26.8%
	Eclectic Coding (MAXQDA)	3	5.4%
Mixed	Mixed: Quantitative + Qualitative Parallel	14	25.0%
Total		**110**	**100.0%**

According to Table 4, the most striking findings are the predominance of quantitative methods—especially the T-Test (39.3%)—and the notable use of SPSS-based analyses. Additionally, the considerable share of mixed methods (25%) highlights an increasing preference for integrating both qualitative and quantitative approaches in dissertations.

The Focus Areas and Distributions in the Teaching of Turkish

Under this main theme, the following sub-themes were identified and explained in detail: the "distribution of language skills", "classification according to the type of teaching Turkish" and "trends in sub-skills and disciplines" as addressed in doctoral dissertations related to the teaching of Turkish.

Distribution of Language Skills

The trends regarding language skills in dissertations conducted in the field of the teaching Turkish were analyzed, and the language skills targeted in the dissertations are presented in Table 5, along with their frequencies and percentages.

Table 5

Distribution of Language Skills Targeted in Dissertations

Language Skill	f	%
Reading	46	80.7
Writing	39	68.4
Listening	19	33.3
Speaking	15	26.3
Vocabulary	11	19.3
Grammar	4	7.0
Visual Literacy	3	5.3

Based on Table 5, it is evident that the majority of dissertations focused on reading skills. Out of 57 dissertations, 46 (80.7%) targeted reading as the primary skill, with particular emphasis on sub-skills such as reading comprehension, fluent reading, and critical reading. Writing was also a frequently studied skill, appearing in 39 dissertations (68.4%). Within this category, topics included informative writing, creative writing, writing motivation, and writing anxiety. Listening and speaking skills were the least studied among the four core language skills; listening was addressed in 19 dissertations (33.3%), while speaking was explored in 15 (26.3%). This suggests that skills related to verbal expression and perception are underrepresented both in instructional processes and in the literature.

Studies focusing on vocabulary, particularly those examining its relationship with other skills like reading and writing, appeared in 11 dissertations (19.3%). The number of dissertations dedicated to formal language elements such as grammar, spelling, and punctuation was quite limited, totaling only 4 dissertations (7.0%). Additionally, visual literacy and visual interpretation were investigated in only 3 dissertations (5.3%), indicating that the perspective of multiliteracies is still marginally addressed.

Classification According to the Type of Teaching Turkish

In recent years, the trend toward teaching Turkish as a second language has become increasingly prominent in the literature, and the types of teahing Turkish were also analyzed in the reviewed dissertations as presented in Table 6.

Table 6

Type of teaching Turkish (as a Mother Tongue and as a Second Language)

Type of Teaching Turkish	*f*	%
Teaching Turkish as a mother tongue	51	89.5%
Teaching Turkish as a second language (L2)	6	10.5%

As shown in Table 6, the classification reveals that the vast majority (89.5%) of the theses focus on teaching Turkish as a mother tongue. In contrast, the dissertations that address teaching Turkish as a second language (10.5%) generally focus on improving the Turkish language proficiency of primary school students with migrant backgrounds or foreign nationals (especially Syrian and Iraqi students). Identifying the focus areas of these theses is important for determining trends in this field. In this context, Table 7 presents the focus areas of the theses that addressed Turkish as a second language.

Table 7

Focus Areas of Dissertations Conducted on Teaching Turkish as a Second Language

Dissertation No	Focus Area
30	Development of Turkish language skills through interactive book reading
31	Development of literacy skills through digital games
42	The effect of interactive reading on reading, vocabulary, and motivation
13	Improving pronunciation skills through educational games
34	Problems encountered in initial literacy instruction and proposed solutions
32	Teaching Turkish as a second language supported by digital games

Based on Table 7, several key trends emerge in classrooms where Turkish is taught as a second language: Interactive reading and writing approaches have been shown to be effective in promoting linguistic development, with students demonstrating improvement across the four main language skills. Digital and educational game-based instruction: The use of digital games in Turkish as a second language education has been reported to enhance student motivation and academic achievement. Pronunciation challenges and solutions: Pronunciation problems stemming from students' native languages, particularly among Syrian learners, can be addressed through educational games. Difficulties in initial literacy instruction: Teachers working with students whose first language is not Turkish have reported various challenges in the teaching process, including a lack of materials, insufficient strategies, and classroom management issues.

Trends in sub-skills and disciplines

In the teaching of Turkish, identifying the sub-skills of the language skills targeted in dissertations is considered important for highlighting trends in the literature, as well as the main language skills themselves. In this context, the language skills and sub-skills that dissertations focused on are presented in Table 8, along with their frequencies and percentages.

Table 8

Distribution of Core Language Skills and Sub-skills

Core Skill / Sub-skill	f	%
Reading		
Reading Comprehension	19	33.3
Fluent Reading	6	10.5
Critical Reading	4	7.0
Visual Literacy	2	3.5
Word Recognition / Reading Difficulties	6	10.5
Writing		
Written Expression	17	29.8
Fluent Writing	6	10.5
Narrative Writing	6	10.5
Creative Writing	10	17.5
Persuasive Writing	2	3.5
Informative Writing	4	7.0
Linguistic Creative Writing	2	3.5
Beginning Writing / Initial Literacy	3	5.3
Listening		
Listening Comprehension	5	8.8
Metacognitive Listening	2	3.5
Speaking		
General Speaking	4	7.0
Interactive Speaking (educational games, presentations, etc.)	2	3.5

Core Skill / Sub-skill	f	%
Language Elements		
Vocabulary / Lexical Knowledge	6	10.5
Grammar and Expression	3	5.3
Application/Activity Types		
Digital Storytelling / Interactive Reading	5	8.8
6+1 Analytical Writing Model	2	3.5
Game-based Instruction	3	5.3
Story Map / Double-entry Journal	2	3.5

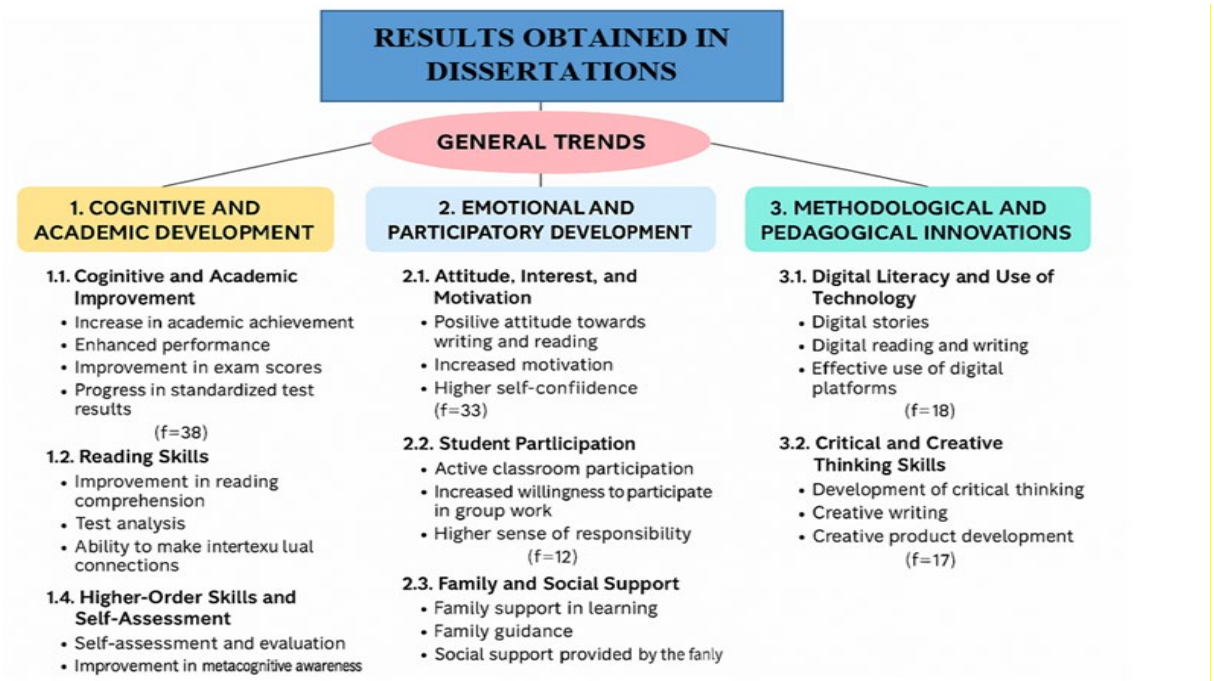
Based on Table 8, the most frequently studied skill area is reading, with “reading comprehension” having the highest frequency at 33.3%. This highlights that meaning-making processes are at the center of the teaching of Turkish at the primary school level. The inclusion of sub-skills such as “fluent reading” and “word recognition/reading difficulties” indicates that the instructional process is considered not only in terms of comprehension, but also in terms of fluency and technical skills. Higher-order reading skills such as “critical reading” and “visual literacy” were studied less frequently, yet reflect the multidimensional nature of literacy. This classification shows that dissertations on the teaching of Turkish are shaped mainly around core skills, but there is also some orientation towards contemporary dimensions such as technological literacy and creative production.

Key Findings in Disertations

Key findings in the research are explained under the themes of (1) cognitive and academic development, (2) affective and participatory development, and (3) methodological and pedagogical themes. These themes are presented in Figure 5.

Figure 5.

Results Obtained in Dissertations



As shown in Figure 5, the main and sub-themes, along with the associated codes, are presented below.

Main theme 1: cognitive and academic development

The majority of studies (66.7%) focused on “student achievement and skill development.” This finding suggests that measurable outcomes of programs or interventions—such as exam success and grades—

continue to be the primary emphasis in educational research. Skills such as writing and reading comprehension underscore the importance of fostering both productive and receptive language abilities. Furthermore, there is a growing focus on metacognitive skills and self-regulation, indicating an increasing awareness of students' ability to manage their own learning. This trend highlights the significance of self-directed learning, which has recently gained prominence as a key component of 21st-century skills.

Main theme 2: emotional and participatory development

Research demonstrates that emotional and participatory development is just as important as cognitive and academic development. Recent studies reveal a growing emphasis not only on students' academic achievements but also on their attitudes toward the course and their motivation to learn. This underscores the importance of emotional factors in creating lasting and meaningful learning experiences.

Contemporary education increasingly prioritizes student participation and engagement in activities, active learning, taking responsibility, and involvement in group work. Additionally, family and social support are identified as crucial contributors, with evidence indicating that home-based learning and family involvement are effective in supporting students' overall development. However, it is evident that this area has not been sufficiently explored in the literature.

Main theme 3: methodological and pedagogical innovations

Research on digital literacy and technology use, which accounts for 15.8% of the dissertations, indicates that educational practices and tools are being examined within the context of the digital age, highlighting a trend toward the integration of technology in education. Additionally, studies on the development of critical and creative thinking, representing 12.3% of the research, reflect a growing focus on supporting 21st-century skills such as innovative thinking and original text production in educational settings.

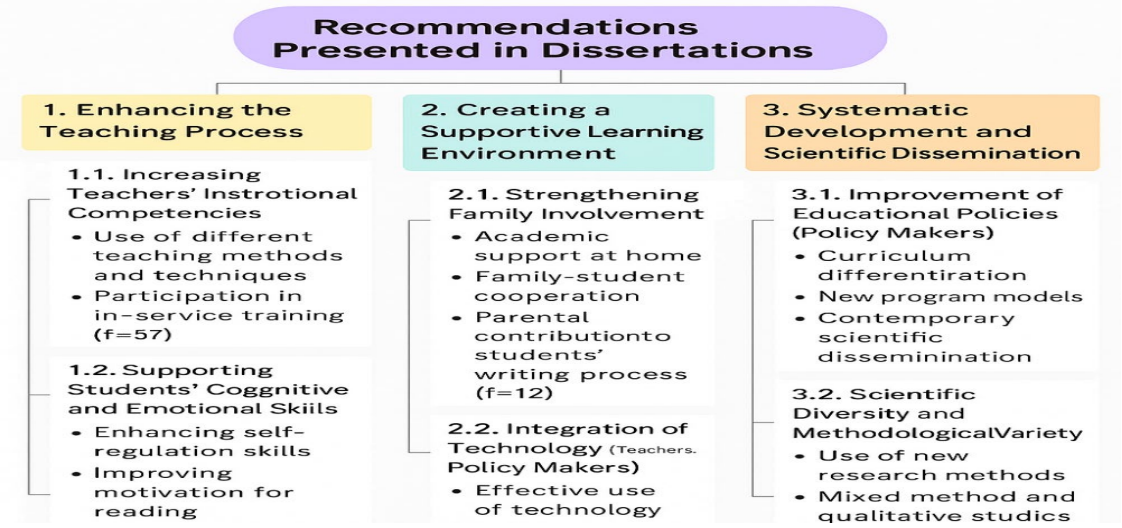
Overall, the findings suggest that while there is a strong emphasis on cognitive and academic development in the dissertations, there is also an increasing interest in emotional, participatory, and methodological innovations.

Recommendations Presented in Dissertations

The recommendations offered in the dissertations are organized under three main themes: (1) improving the teaching process, (2) creating a supportive learning environment, and (3) systematic development and scientific dissemination. These themes are illustrated in Figure 6.

Figure 6

Recommendations Presented in Dissertations



The main and sub-themes, as well as the codes related to these themes, shown in Figure 6 are explained below.

Main theme 1: improving the teaching process

The most prominent recommendations (f: 57, 100%) focus on enhancing teachers' professional development and teaching skills. Key suggestions include utilizing a variety of methods and techniques, strengthening in-service training, being responsive to individual differences, and implementing process-based assessment. It is also emphasized that students should be supported not only academically but also in affective domains such as self-regulation and motivation (68.4%). Contemporary learning approaches, in line with the principle of "holistic student development," highlight the importance of higher-level learning outcomes, including writing habits and motivation.

Main theme 2: creating a supportive learning environment

Recommendations for strengthening family involvement highlight that the active participation of families in education, providing academic support at home, and fostering cooperation with students contribute positively to student success (f: 12, 21.1%). Furthermore, integrating technological materials, Web 2.0 tools, and developing digital content are identified as top priorities for both teachers and policymakers (f: 13, 22.8%).

Main theme 3: systematic development and scientific dissemination

This main theme encompasses policy-oriented recommendations, such as differentiating curricula, creating new program models, and incorporating contemporary language teaching components, all aimed at macro-level system development. To ensure scientific continuity and methodological diversity, the proposals suggest targeting new age groups, conducting long-term impact studies, and employing combinations of qualitative and quantitative methods—reflecting the need for depth and sustainability in scientific knowledge production.

Discussion

The primary aim of this study was to critically analyze doctoral dissertations on the teaching of Turkish in primary education in Türkiye from multiple perspectives. Drawing upon a systematic review of 57 dissertations completed between 2022 and 2025, this discussion is structured around the following key dimensions: (1) bibliometric characteristics and trends, (2) methodological characteristics and trends, (3) focus areas and distributions in the teaching of Turkish within primary education, (4) key findings derived from the dissertations, and (5) the main recommendations put forward in the studies. Each dimension is examined in depth, based on both quantitative data and thematic analyses.

An analysis of doctoral dissertations in the field of Turkish language teaching, in terms of year, university, and volume of production, reveals that dissertation output peaked in 2022, declined sharply in 2023, rose again in 2024, and remained low in the first half of 2025. Gazi University leads in dissertation production, while Hacettepe, Trabzon, and Istanbul universities make moderate contributions. Research in Turkish language teaching remains concentrated in a few central institutions, with limited regional diversity. Similar trends are reported in previous studies (Boyacı & Demirkol, 2018), where research activity was clustered in key centers. Özenç & Özenç (2018) reported that Marmara University ranked first by university variable, followed by Gazi and Hacettepe Universities. This difference can be explained by variation in sampling periods and fields covered. Kesik and Ciğerci (2020) also found that Marmara University ranked highest for all primary education dissertations, followed by Gazi University. Bektaş (2021) similarly noted that theses were largely concentrated in certain universities and that regional diversity remained limited. The findings of Ozan & Küçükoğlu (2013) also support this observation, indicating that statistical analyses showed limited diversity in institutional representation.

From an internal synthesis perspective, the current study confirms a long-standing pattern: the institutions leading in production during 2022–2025 are largely the same as those identified in earlier periods. This continuity suggests that institutional dominance is a structural feature rather than a short-term fluctuation. Externally, these findings align with UNESCO (2023), which notes that in many countries, research in teacher education and language teaching is concentrated in metropolitan universities with greater research capacity. Such concentration may restrict the diversity of perspectives in the field.

Regarding methodological characteristics, most dissertations focus on describing the current situation, while a smaller number aim to develop new practices or models. Quantitative methods predominate, but the notable use of mixed methods aligns with the need for concrete outcomes in classroom practice. This trend has also been observed by Demirkol et al. (2023) and Kesik & Ciğerci (2020), who reported the dominance of experimental and mixed-method designs. In contrast, Önal and Maden (2021) found that qualitative designs are more common in different subfields of Turkish education, indicating that methodological tendencies vary by subfield. Ozan & Küçükoğlu (2013) found that, in theses within the field of elementary teacher education, quantitative methods, particularly the descriptive survey model, predominated, with questionnaires and Likert-type scales as the most frequently used tools, and t-tests and ANOVA as the most common analyses. This demonstrates that the methodological tendencies seen in recent doctoral dissertations are consistent with earlier trends.

However, although the use of mixed methods has increased in recent years, it often remains confirmatory rather than exploratory—typically combining descriptive surveys with limited qualitative follow-up. This suggests that methodological innovation is still emerging rather than fully established. Moreover, Creswell and Plano Clark's (2018) framework for mixed methods emphasizes integration at both the data collection and analysis stages, whereas in most dissertations reviewed here, integration occurred primarily at the reporting stage.

With respect to participant profiles, researchers most frequently selected 4th grade students and their primary school teachers. Many studies focused solely on 4th graders, likely because academic outcomes can be more readily measured at the end of primary school. The rare inclusion of groups such as students with special needs, bilingual students, or pre-service teachers suggests a preference for easily accessible samples. Yıldırım Suna & Benzer (2023) also found that in research on higher-order thinking skills, accessible participant groups predominated, with disadvantaged groups seldom represented. The alignment between participant selection and methodological choices is notable: studies employing experimental or quasi-experimental designs often favor homogeneous, easily accessible groups to control variables, potentially at the expense of ecological validity. As Bryman (2016) has observed, an overemphasis on methodological control in educational research can reduce the applicability of findings to diverse classroom contexts.

Considering the tools used for data collection, semi-structured interviews and achievement tests were most commonly employed. Interviews enabled an in-depth analysis of teacher and student experiences, while achievement tests measured instructional outcomes. Other tools—including observation forms, researcher diaries, rubrics, and questionnaires—provided multiple perspectives on the learning process. This methodological variety results from the increased use of mixed methods and reflects researchers' growing attention to both outcomes and processes. The use of diverse data sources, as advocated by Creswell and Plano Clark (2018), and the rising methodological awareness reported in feedback-focused studies (Özalp & Kaymakçı, 2022), further support this finding. Similarly, Bektaş (2021) emphasized that, particularly in studies employing mixed methods, data collection instruments had diversified, with teacher interviews, achievement tests, and observation forms being used in combination.

From the perspective of data analysis techniques, most dissertations relied on basic statistics such as t-tests, along with qualitative methods like descriptive analysis. Researchers frequently combined quantitative and qualitative analyses to interpret their data. The increased use of mixed analysis techniques reflects a growing interest in blended methodologies, consistent with the multi-paradigm approach described by Johnson, Onwuegbuzie, and Turner (2007). However, the limited application of advanced statistical techniques and the continued reliance on descriptive analyses point to a need for deeper data analysis. This is also noted by Kanat (2021) and Maden (2021), who observed the persistent dominance of traditional techniques and a lack of methodological diversity.

In terms of research trends related to language skills, studies predominantly focus on reading and writing. Many dissertations investigate reading comprehension, fluent reading, and critical reading, underscoring the importance of text analysis at the primary level. Writing is frequently addressed, both in creative and informative forms, with attention also given to psychological factors such as motivation and anxiety. Similar results were found by Önal & Maden (2021), who highlighted the prominence of writing and the frequent focus on reading. However, oral skills such as listening and speaking remain underrepresented,

and skills like think-aloud, feedback, or discussion are rarely explored. Researchers seldom focus on formal language elements such as grammar and spelling, instead prioritizing functional skills. Özenç (2023) noted that most dissertations addressed meaning-oriented topics, with formal elements receiving less emphasis. This uneven focus has also been confirmed by Özalp & Kaymakçı (2022). Yıldız (2020) and Ozan & Küçükoğlu (2013) likewise found that reading and writing dominate topic distributions, while listening and speaking receive very limited attention, indicating that the imbalance revealed in the present study reflects a long-standing trend.

Within the context of the type of Turkish language teaching addressed, nearly all dissertations focus on Turkish as a first language. Only a small subset, mainly concerning Syrian or Iraqi students, explored the teaching of Turkish as a second language through interactive or game-based methods. The limited number of such studies highlights a need for more research on bilingual students. This need is also emphasized by Yılmaz Can & Kaya (2022), who reported that dissertations on Turkish as a foreign or second language make up a very small proportion of the overall literature. UNESCO (2023) likewise underscores the urgent necessity of developing strategies for multilingual classrooms, suggesting that more research should focus on pedagogical differentiation in multicultural contexts.

The dominance of reading and writing also mirrors participant selection patterns: most interventions are designed for measurable academic outcomes, which are easier to quantify in reading and writing than in oral skills. In contrast, Council of Europe (2020) advocates for balanced skill development, including listening and speaking, as essential for communicative competence, indicating that the current doctoral research landscape does not yet fully align with international language education standards.

When sub-skills and contemporary perspectives are considered, dissertations in Turkish language teaching most commonly emphasize reading comprehension, with sub-skills such as fluent reading and word recognition also frequently addressed. Higher-order skills, like visual literacy and critical thinking, are less commonly studied, and perspectives such as multiliteracies and media literacy remain largely unexplored. Maden (2021) notes that research continues to prioritize traditional skills, with digital-age skills only rarely being addressed. This suggests that while core skills remain central, there is an evident need to investigate creative, digital, and critical literacy skills. The lack of interdisciplinary connections—such as links with science or mathematics literacy—represents a notable area for future development.

With regard to research findings, dissertations primarily aim to enhance students' cognitive and academic development. Most studies evaluate the effects of specific models or interventions on reading comprehension, writing, and academic achievement, often through action research. Boyacı & Demirkol (2018) and Önal & Maden (2021) also noted a strong emphasis on improving classroom achievement and evaluating curricula, reflecting a continued "input-output" orientation in the field. Some dissertations also address affective and participatory development, focusing on students' attitudes, motivation, self-confidence, and adaptation to participatory learning environments. These findings indicate a growing awareness of affective factors in learning. However, most research continues to focus on individuals, with limited attention to family support. Demirkol et al. (2023) observed that affective data are typically collected through self-report forms, and family contributions are seldom examined. The need for more comprehensive studies supporting holistic student development is also highlighted by Özalp & Kaymakçı (2022), who point out the lack of research on contextual factors such as collaborative learning and family-school cooperation.

Another significant theme is methodological and pedagogical innovation. In recent years, dissertations have increasingly addressed digital tools, digital literacy, and technology integration, while innovative instructional strategies such as creative writing, critical thinking, and multimodal text production are gaining attention, though their numbers remain limited. Kanat (2021) and Maden (2021) both found that research on digital-age skills is only just emerging. This indicates a gradual but incomplete shift from traditional literacy skills toward critical, creative, and digital literacies. Such studies also show potential for cross-disciplinary integration with educational technology research, aligning with global calls to integrate 21st-century skills into primary education (Voogt et al., 2016).

Most recommendations in these dissertations focus on improving the teaching process, creating supportive learning environments, and strengthening systematic development and scientific dissemination. These recommendations aim to foster cognitive, pedagogical, affective, and structural transformation in

Turkish language teaching. The most common recommendation is to support the professional development of primary school teachers and enhance the effectiveness of teaching practices. Researchers emphasize methodological diversity, the use of contemporary techniques, and more practice-oriented in-service training, as well as greater attention to individual differences and the promotion of process-based assessment.

Many recommendations also address students' self-regulation, writing habits, and motivation, supporting the need for a holistic approach to instructional design. Boyacı & Demirkol (2018) and Demirkol et al. (2023) argue that teacher education should address both instructional and affective development. In terms of supportive environments, recommendations highlight the importance of family involvement and digital learning materials; strengthening the role of families and teacher-family cooperation is viewed as essential for enhancing student achievement. The development of digital content and the use of Web 2.0 tools are also identified as key strategies. Özalp & Kaymakçı (2022) further stress the value of digital literacy for both student motivation and teacher competence.

Enriching classroom environments with both physical and digital tools is recommended to support multidimensional language development. At the policy level, recommendations include curriculum differentiation, integration of contemporary approaches, and the development of new instructional models. Dissertations also propose long-term studies to monitor the effects of interventions, as well as more research on diverse student groups and various educational contexts to promote continuity and inclusivity in scientific research. The need for greater methodological diversity and interdisciplinary approaches is also emphasized by Önal & Maden (2021). Overall, research on Turkish language teaching, particularly within classroom settings, holds significant potential to drive pedagogical transformation and enrich the field's scientific foundations.

Conclusion

This study provides a comprehensive overview of recent doctoral dissertations on teaching Turkish, focusing on both content and methodological trends. The analysis shows that dissertation production is concentrated in a few leading universities and varies significantly from year to year. Research in this field mainly describes the current state of Turkish language education, with relatively few studies aimed at developing new models or innovative practices. Quantitative methods are predominant, although mixed-methods research is becoming increasingly common. The most frequently studied participants are fourth-grade students and their teachers, while research involving diverse or disadvantaged student groups remains limited.

Regarding data collection, semi-structured interviews and achievement tests are the most commonly used tools, supported by observations, researcher diaries, rubrics, and questionnaires. Basic statistical and descriptive analysis techniques are most prevalent, while advanced data analysis methods are used less frequently. In recent years, there has been a gradual increase in studies focusing on digital literacy and innovative teaching strategies; however, the majority of research still centers on traditional reading and writing skills. Listening, speaking, and multiliteracy skills are underrepresented, highlighting areas that require further attention.

This imbalance reflects a persistent gap between national doctoral research agendas and the multidimensional skill frameworks advocated in policy documents such as Türkiye's 2023 Education Vision. The gap is even more evident when compared to Council of Europe (2020) balanced approach to language skill development, underscoring the need for curricular and research alignment with international standards.

Most studies primarily aim to enhance students' cognitive and academic development, but affective factors such as motivation, self-confidence, and participation are gaining more recognition. There is a growing focus on digital transformation and integrating creative and critical thinking skills into teaching Turkish. However, comprehensive studies addressing family support, collaborative learning, and multicultural classroom practices remain scarce.

This reflects a gradual expansion of research scope, though still lacking in holistic perspectives that integrate cognitive, affective, and social dimensions. Externally, this aligns partially with global calls for

whole-child education (UNESCO, 2023), yet indicates that Turkish doctoral research is still in the early stages of adopting such approaches.

In conclusion, doctoral dissertations on teaching Turkish play a crucial role in strengthening the scientific foundation of the field and hold significant potential for driving educational transformation. Internally, the persistence of certain patterns indicates that change will require coordinated institutional and policy-level interventions, not just individual research initiatives. Aligning research priorities with global trends in language education—particularly in multilingual and digital contexts—will be critical for ensuring the international relevance and impact of the field. Expanding the research agenda with more inclusive, innovative, and holistic approaches will contribute to the development of both students and teachers and advance the field as a whole.

CRediT authorship contribution statement

All review, analysis and writing process was completed by the author.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics Committee Approval Information

This study was conducted as a systematic review of doctoral dissertations; therefore, ethics committee approval was not required.

Declaration of AI Usage Statement

During the preparation of this manuscript, artificial intelligence tool ChatGPT-4o was utilized exclusively for the purposes of language editing and proofreading. The data obtained from AI tools has been thoroughly reviewed according to established ethical and academic standards. The AI tools are not credited as authors; the authors are solely responsible for the content of the published article.

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