



The Effect of Educational and Digital Educational Games on Academic Achievement and Friendship in Teaching Addition and Subtraction

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Abstract: This study investigates the effects of educational and digital educational games on students' basic arithmetic skills and friendship relations in teaching addition and subtraction, which are among the fundamental skills of mathematics education. The research was conducted with students aged 72-84 months and employed a parallel mixed-methods design. Three groups were included in the study: one taught through digital educational games, one through traditional educational games, and one through conventional teaching methods. According to the quantitative findings, digital educational games were more effective than educational games, while educational games were more effective than traditional methods in developing addition and subtraction skills. The qualitative findings revealed that educational games had a greater positive impact on friendship relations compared to digital educational games. Furthermore, educational games supported students' face-to-face communication and cooperation skills more strongly. Overall, while digital educational games improved addition and subtraction skills, educational games contributed positively to the strengthening of friendship relations. These findings suggest that using both types of games together may provide more comprehensive benefits.

Key words: Educational Games, Digital Educational Games, Academic Achievement, Friendship

1. Introduction

Mathematics education is a vital component of curricula worldwide. The process of learning mathematical concepts begins in early childhood, and the knowledge gained during this period can be a prerequisite for mathematical skills that will be used later in life (Linder, Powers-Costello & Steglin, 2011). Since mathematics and mathematical thinking are structures that exist in daily life and that we encounter even before starting school, mathematics should not be considered separately from everyday life (Tabak & Aktürk, 2018). We frequently use mathematics in daily life, such as when reading the time on a clock, pressing the button for the floor we want to go to in an elevator, using measurements in cooking recipes, estimating the arrival time based on the relationship between speed and time while traveling, comparing prices while shopping, calculating discounts, or determining the total cost of our purchases. Addition and subtraction are among the most important of these skills.

The ability to perform addition and subtraction is a fundamental arithmetic skill and one of the mathematical skills frequently used in daily life. These two mathematical skills are ones that children should acquire at an early age. This is because these skills are an important and critical foundation for more complex mathematical operations that they will learn later in their academic lives (van de Walle et al., 2017). Addition is the mathematical skill of calculating the total value by bringing two or more numbers together. For example, the sum of 3 and 2 can be expressed as $3 + 2 = 5$. In this operation, the quantities 3 and 2 are combined to get the total result. The operation of addition is a fundamental step for understanding the combination and increase of numbers or quantities (Reys et al., 2020). Subtraction is the process of finding the remaining quantity by subtracting one number from another.

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For example, by subtracting 3 from the number 5, the remaining value is calculated as 2. This operation is mathematically expressed as $5 - 3 = 2$. Subtraction is critically important for understanding the concepts of difference, decrease, and reduction from a mathematical perspective (Carpenter et al., 2015).

The ability to perform addition and subtraction is one of the foundational steps for the development of mathematical thinking skills. These two skills don't just help us solve problems in math class. The ability to add and subtract is also frequently used in daily life activities such as calculating money amounts while shopping, using and managing time effectively, and budgeting (NRC, 2001).

The process by which children acquire addition and subtraction skills commonly begins with operations using concrete objects, and later, this process becomes abstract through mental operations (Fuson, 1988). Clements & Sarama (2020) explained this developmental process in three phases:

1. Concrete Phase: Addition skills are acquired using objects. For example, by adding 3 pencils to 5 pencils, the result of 8 pencils is reached.
2. Semi-Abstract Phase: Operations are performed with the help of visuals or drawings.
3. Abstract Phase: Numbers are used when performing addition and subtraction, and the ability to calculate mentally develops.

Piaget divided an individual's cognitive development into four stages: sensorimotor (0-2 years), preoperational (2-7 years), concrete operational (7-11 years), and formal operational (11 years and up). The concrete operational stage of Piaget's Theory of Cognitive Development aligns with the period when addition and subtraction skills are acquired, as described by Clements & Sarama (2009). Considering the concrete operational stage, making an abstract subject like mathematics tangible will ensure lasting learning. Furthermore, by making mathematics more concrete, it can become a subject they learn while having fun, rather than one they perceive as difficult (Baykul, 2003). In this concretization process, play is one of the most important types of activities.

Play is defined as an activity based on specific rules that develops an individual's abilities, has a certain purpose (Çoban & Nacar; 2006), and is the common language of all children (Bennett, 2002). This language makes significant contributions to children's physical, emotional, cognitive, social, and psychomotor development (Aykaç & Köğçe, 2020). According to Vogt et al. (2018), children gain more from play-oriented approaches than from direct instruction. Therefore, games should be designed in a way that motivates students (Pivec, Dziabenko & Schinnerl, 2003). Play also allows a child to present what they have learned while, at the same time, contributing to the learning processes of their friends (Wood, 2009). These contributions have led to the use of games in educational activities, giving rise to the game-based learning approach.

Game-based learning is a learning approach where concepts are transferred gradually, participants are interactive, and there is a specific goal (Anastasiadis, Lampropoulos & Siakas, 2018). This approach centers on students' interests and needs, which allows them to enjoy the learning experience and actively use all their senses (Tuğrul, 2014). In game-based learning, where the student is an active participant, the source of motivation is intrinsic, and the focus is on learning rather than winning or losing (Al-Azawi, Al-Faliti & Al-Blush, 2016). Feedback provided during the game process also helps to increase interest in learning (Cheng & Su, 2012).

Some definitions of game-based learning also highlight the relationship between mathematics and play. Faulkner (1995) describes this relationship as an activity where mathematical thinking skills are developed and real-life is experienced. This is because a child experiences many mathematical situations during the play process, which they find enjoyable (Tuğrul, 2000). Mathematical games experienced in early childhood will play an important role in laying the foundation for mathematics education in later years (Sarama & Clements, 2009).

1.1. The Importance of Educational and Digital Educational Games in Education

Educational and digital educational games, when prepared in alignment with learning objectives, positively support learning processes. They increase students' motivation toward the lesson. These are learning tools designed to make the learning process fun, moving it away from the traditional

classroom setting. These games, especially in subjects like mathematics, language, and science, enrich learning environments while helping students understand abstract concepts by making them concrete (Habgood & Ainsworth, 2011). When games are used as a tool in the educational process, the selected games should be simple and support active participation, suitable for all students' levels (Karamustafaoğlu & Kılıç, 2020).

Games provide positive contributions to the learning process in many ways. In mathematics education, the use of games allows children to make abstract concepts of numbers and shapes concrete by experiencing their physical forms (Sarama & Clements, 2009). Since these games help children have fun and increase their interest in mathematics, they also boost their motivation (Ginsburg, Lee & Boyd, 2008). Educational games enable students to develop solutions to the problems they encounter. Games played in groups help children interact with each other and develop their communication skills in a collaborative manner (Vygotsky & Cole, 1978). Additionally, during games, students notice and correct their mistakes, which helps them learn faster than they would normally (Gee, 2003).

Educational games are tools created with pedagogical goals in mind that allow students to learn by playing. The purpose of educational games is to make the information that students need to acquire applicable while also ensuring that the learning process is enjoyable. Research shows that at the end of learning processes planned with educational games, students' problem-solving skills improve, they actively participate in the process, and they gain learning opportunities from the mistakes they make (Kiili, 2005).

The activities in educational games offer experiences where students can learn individually as well as in a group. While educational games ensure students' active participation in the learning process, they are also learning tools that make abstract concepts concrete (Yavuzkan, 2019). Through educational games, students acquire not only academic knowledge but also develop certain social skills.

Digital educational games aim for the same results as traditional educational games. Digital educational games are technology-supported games designed to achieve specific goals. This type of game offers personalized learning experiences to students because they can be planned according to individual levels and learning speeds (Gee, 2003). In abstract subjects like mathematics, concepts presented visually through games can facilitate learning (Van Eck, 2006). Digital games provide visuals and interaction, which allows students to participate actively in the learning process. An actively participating student can immediately notice their mistakes, thereby accelerating the learning process. The rapid development of technology allows digital educational games to become even more effective. With the inclusion of technological advances like Augmented Reality (AR) and Virtual Reality (VR) in educational processes, game-based learning activities have become even richer (Zhang et al., 2020).

In the literature, there are numerous game-based studies for different age groups and grade levels. In the study titled "Using a Multi-Dimensional Model of Gender to Assess Learning with Different Game-Based Learning Narratives," Stec et al. (2024) examined the effects of traditional learning versus digital game-based learning in the context of gender. Polydoros & Antoniou (2025), in their study "Empowering Students with Learning Disabilities: Examining Serious Digital Games' Potential for Performance and Motivation in Math Education," conducted research with two groups of students with learning disabilities. In their study, the experimental group used a digital game called "Battleship," while the control group followed the traditional curriculum. They found a difference in favor of the experimental group in terms of math achievement but a difference in favor of the control group in terms of math motivation. Liman & Kaban (2025), in their study "Escaping Traditional Learning: The Role of Educational Digital Escape Games on Achievement and Motivation in Primary Math Education," examined the effect of digital escape games designed according to the ADDIE model on math achievement. The research sample consisted of an experimental group that learned with digital games and a control group that learned with traditional methods. The results of the study were significant in favor of the experimental group. Additionally, a positive correlation was found between motivation and achievement, but no difference was detected between the groups in terms of general motivation. Pomeranz (2024), in his study "Use of Minecraft Education to Teach 5th Grade Common Core Mathematics Standards Relating to Measurement of Geometric Volume," found that

the game Minecraft increased students' academic achievement.

In the literature, there are studies on educational and digital educational games (Lin, 2002; Gomez & Garcia, 2022; He, 2017). These studies have mostly examined the effects on children's cognitive, social, and emotional processes. The majority of the studies were conducted with a preschool working group. However, the current research focuses on the cognitive and social processes of first-grade students using both educational and digital educational games.

Along with the digitalized world, there are debates that individuals' social skills are being negatively affected. One of these skills is friendship. Friendship is a voluntary, positive-emotional interpersonal bond (Howes, 2009) that allows individuals to develop emotionally and mentally (Hojjat & Moyer, 2017). Through this developmental process, a person gets to know themselves with friendship skills, which aids in identity formation and the development of empathy (Bukowski, Motzoi & Meyer, 2009). Therefore, when conducting studies to increase academic achievement in the educational process, the effect on social skills should not be ignored. As friendship experiences increase, students' adaptation to school also increases. This is a skill that will positively affect children's school life throughout their learning processes.

This research examines the effects of educational and digital educational games on teaching addition and subtraction and offers innovative approaches to improving the mathematical skills of 72-84 month old students. Educational games make the learning process fun by increasing students' interest in the lesson and help make mathematical concepts tangible. Digital educational games, in particular, enable students to participate actively in the learning process and offer personalized learning experiences through the visual and interactive opportunities provided by technology. This is important as it demonstrates the role of technology in education. Although there are studies on the use of games in mathematics education, this research is considered important because there are few comparative studies that specifically compare educational games and digital educational games, as is done in this study. In this context, the research findings will contribute to educators and policymakers re-evaluating their teaching strategies and gaining awareness about the integration of game-based learning methods into prepared curricula and which game style is more effective. Furthermore, with the introduction of games into educational processes, the focus of this research has been to determine which type of game increases academic achievement and how it contributes to friendship, one of the social skills that has been impacted by digitalization. This aspect makes the study original. Therefore, the research questions to be answered have been determined as follows:

1. How does the addition and subtraction skill of children who are educated with digital educational games change compared to children who are educated with traditional educational games?
2. In what ways do the types of games contribute to the sense of friendship among students?

1.2. Research Purpose

The ability to perform addition and subtraction is one of the fundamental building blocks of mathematics and a skill used in our daily lives and in many fields. It is a prerequisite for learning more complex mathematical operations like multiplication and division. At the same time, the ability to add and subtract is an important skill used in situations encountered in daily life. The purpose of this research was to examine the effect of games used in the classroom to develop the basic math skills of addition and subtraction in students aged 72-84 months. In particular, it aimed to determine whether the game-based teaching method is more effective than traditional teaching methods and which type of game is more effective.

2. Research Methodology

This study was conducted using a parallel mixed-methods research design. Mixed-methods research uses both qualitative and quantitative approaches together to collect and analyze more data, which allows for a better understanding of the research problem (Creswell & Plano Clark, 2006; Johnson & Turner, 2006; Leech & Onwuegbuzie, 2009). The data obtained from quantitative and qualitative methods can support each other, allowing for more in-depth analysis together and paving the way for the development of new research topics from different perspectives on any contradictions that may

arise (Rossman & Wilson, 1994). The parallel design allows for a comprehensive evaluation of the research at both the statistical and contextual levels (Creswell & Plano Clark, 2018).

To obtain the quantitative data, a posttest-only control group design was used from experimental research. In this design, there are experimental and control groups, no pretest is given, and a posttest is administered at the end of the intervention to compare the average scores (Sönmez & Alacapınar, 2021). For the qualitative data, a case study method was utilized. A case study is a method of gathering information and describing a phenomenon by examining it within its natural world (Creswell & Creswell, 2017; Yin, 2009). Descriptive analysis was used to analyze the quantitative data, while content analysis was used for the qualitative data.

2. 1. Study Group

The research was conducted at a public school in Istanbul, Turkey. The study involved a digital educational games experimental group (Group 1), an educational games experimental group (Group 2), and a control group that followed the traditional teaching process (Group 3). The students in the groups were between 72-84 months of age and were assigned randomly. Based on interviews with the teachers, students who did not already have addition and subtraction skills were included in the study. All groups were composed of 20 students. The gender distribution of the groups is as follows.

Table 1. Gender Distribution

	MALE	FEMALE	TOTAL
Group 1 (Digital Educational Games)	8	12	20
Group 2 (Educational Games)	11	9	20
Group 3 (Traditional Methods)	12	8	20

The qualitative data for the research was obtained from interviews conducted with two teachers who worked with the experimental groups (Groups 1 and 2).

2.2. Data Collection Tools

2.1.1. Quantitative Data Collection Tools

Starting from the 2024-2025 academic year, a new curriculum has been implemented in Turkey. For this research, the 1st-grade mathematics curriculum's theme, "From Algebra to Computational Thinking," was selected. A plan was designed to cover this theme over 3 weeks, totaling 15 class hours.

To address the learning outcome "to perform non-carrying addition with numbers smaller than or equal to 20 (including 20) and non-borrowing subtraction with numbers smaller than or equal to 20 (including 20)," the researcher prepared 25 addition and 25 subtraction problems. Expert opinion was sought on the 50 problems, and a meeting was held with three classroom teachers for this purpose. From the prepared problems, 10 addition and 10 subtraction problems were selected for use in the study.

2.1.2. Qualitative Data Collection Tools

Qualitative data was gathered through interviews with the teachers who implemented the educational process during the study. During the interviews, questions were asked to understand how the teachers observed the effects of both digital and traditional educational games on friendship. The following questions were posed to the teachers who worked with Groups 1 and 2.

Table 2. Questions asked to the Teachers

GROUP 1 INTERVIEW QUESTIONS	GROUP 2 INTERVIEW QUESTIONS
Based on your observations, how do friendship relationships develop among children who play digital educational games?	Based on your observations, how do friendship relationships develop among children who play educational games?

What is the effect of these games on children's cooperation and communication skills?	What is the effect of these games on children's cooperation and communication skills?
Compared to children who learn with traditional methods, have you observed any differences in the social interactions of children who play digital educational games?	Compared to children who learn with traditional methods, have you observed any differences in the social interactions of children who play educational games?
What do you think about the contribution of digital educational games to children's empathy and emotional intelligence development?	What do you think about the contribution of educational games to children's empathy and emotional intelligence development?
How do you think digital educational games affect children's participation in group work?	How do you think educational games affect children's participation in group work?
Do you think these games strengthen children's friendships? Why?	Do you think these games strengthen children's friendships? Why?
Have you observed whether the experiences children have while playing games are reflected in their friendships within the classroom?	Have you observed whether the experiences children have while playing games are reflected in their friendships within the classroom?

2.3. Application Process

This research investigated the effect of educational and digital educational games on teaching addition and subtraction, as well as how this process contributes to students' sense of friendship. Two experimental groups and one control group were formed for the study. The first group completed the teaching process using digital educational games, the second group with traditional educational games, and the third group with traditional teaching methods. The process was planned for a total of four weeks and twenty hours.

At the end of the process, quantitative data was collected using expert-validated worksheets to determine academic achievement. In addition, to examine changes in students' friendship skills, the researcher completed the process by conducting interviews with the teachers who worked with the first (digital educational games) and second (educational games) groups.

This section describes one example application each for digital educational and traditional educational games.

2.3.1. Digital Educational Game Example

For this research, a digital learning environment (Matific) was used to develop students' addition and subtraction skills and to determine the effects of this process on their academic achievement and sense of friendship. This platform created a fun, practical, and learnable experience for mathematics for this age group.

Matific, by its general design, is a platform where students can work at a pace that suits their individual learning speeds. Students participated in the application using the computers in the school's computer lab. Under teacher guidance, they completed the games and tasks available on the platform to develop their addition and subtraction skills. These activities included various applications such as simple counting, using a number line to advance, and grouping objects.

The work conducted on the Matific platform was planned in three steps:

Preparation: Before starting the application, individual user accounts were created for each student. These accounts were necessary for students to access the platform and for their progress to be tracked. To ensure students could easily access the platform, the school's computer lab equipment was checked for functionality and internet access. Before the study, parents were informed about the purpose of the study, how to use the Matific application, and their children's role. Students were also encouraged to use the application at home.

Introduction to the Matific Application: The students participating in the study were gathered in the computer lab. A general introduction to what the application is, what it's used for, and the platform's features was provided. Students were given their usernames and passwords, and each was ensured to

be able to log in. The access process was explained to the students, and they were allowed to try and explore the application themselves.

Application Process: The Matific application was used in the computer lab under teacher supervision. The teacher identified games within the application related to forward and backward rhythmic counting, as well as addition and subtraction skills. These games were implemented on an individual basis. Additionally, students who completed their individual tasks were enabled to help their friends who were struggling. This was believed to contribute to friendship relationships. During the application process, the teacher walked around the classroom and guided students on points where they were struggling. All students were ensured to complete the games either individually or with peer assistance.

2.3.1. Digital Educational Game Example

In our study, the educational game titled “I Hunt Numbers” was used to develop students’ basic operational skills in addition and subtraction.

Preparation Phase: In this phase, the necessary materials for the game were procured. First, multiple copies of number cards from 1 to 20 were prepared, along with operation cards indicating addition and subtraction signs. A table where the students would gather and on which the cards would be placed was set up in the classroom. A board to write the scores was also placed in a suitable location.

Arrangement of the Game Environment and Informing the Teacher: The number cards were spread out on the table in the classroom. The game environment was arranged to ensure the students’ comfort. The teacher who would be implementing the game was given information about the rules, possible scenarios, and how to manage the game.

Introduction of the Prepared Game to the Students: The students were informed that the name of the game they would be playing was “I Hunt Numbers.” They were told that the purpose of this game was to teach addition and subtraction skills in a fun way. The importance of thinking quickly and being a collaborative team was also discussed.

Game Rules: All cards were placed on the table with the numbers facing up. The class was divided into two groups and lined up at a starting line. The teacher first announced which operation was to be performed. Then, two numbers were called out, and the students at the front of the line were expected to perform the operation mentally and find the card corresponding to the result from the table. The first group to find the correct card was awarded 10 points.

Application Process: The teacher moved to a suitable spot in the classroom. First, for addition, the teacher sequentially called out the numbers 6 and 4. After saying these, the teacher used guiding phrases such as, “What do we get if we add 4 to 6?”

Since the students were in a competitive situation, they were encouraged to be respectful toward one another. Due to the fast pace of the game, students developed their ability to perform mental calculations quickly. As the operations were repeated continuously, automaticity was achieved, and it was observed that correct answers came faster toward the end of the game.

Because the class was divided into two groups during the “I Hunt Numbers” game, there was intense peer communication among the students. It was observed that due to the competition, each group cheered for their teammates, applauded the one who got it right, consoled the one who lost, and encouraged them for the next game.

2.4. Data Collection and Analysis

Descriptive content analysis was used for the data analysis. The study was conducted with students aged 72-84 months. Accordingly, to reveal students’ basic operational skills (addition and subtraction), data was collected as a post-test using worksheets prepared by the researcher and finalized after receiving expert opinion at the end of the teaching process. The collected data was analyzed using the arithmetic mean and percentage.

To determine how the types of games contribute to students’ sense of friendship-which was the other research question-interviews were conducted with the teachers at the end of the four-week process.

Notes were taken during the interviews, and these were subsequently divided into sub-themes. While dividing the research into themes, assistance was sought from two field experts who are active classroom and mathematics teachers. The inter-rater reliability formula was used when calculating the reliability between coders (Miles & Huberman, 1994). The average reliability coefficient for the second sub-objective of the research was calculated as 0.90. According to Miles & Huberman (1994), if the reliability coefficient is 0.80 or higher, the research is considered reliable.

3. Findings

3.1. Findings Related to the First Sub-Problem

How does the operational skill of children educated with digital games in addition and subtraction differ from that of children educated with educational games?

Table 3: Percentage and Arithmetic Means from Addition and Subtraction Operations

	Addition Operations				Subtraction Operations			
	Frequency	Correct	Incorrect	Percentage	Arithmetic Mean	Correct	Incorrect	Percentage
Group 1 (Digital Educational Games)	20	182	18	91%	9.1	165	35	82.5%
Group 2 (Educational Games)	20	175	25	87.5%	8.75	134	66	67%
Group 3 (Traditional Methods)	20	122	78	61%	6.1	98	102	49%

Upon examining the data, a significant difference in success percentages and arithmetic means is evident among the groups for both types of operations.

The table shows that Group 1, which used digital educational games, achieved a 91% success rate for addition, with an average of 9.1 correct answers, and an 82.5% success rate for subtraction, with an average of 8.25 correct answers. Group 2, which used educational games, achieved an 87.5% success rate for addition, with an average of 8.75 correct answers, and a 67% success rate for subtraction, with an average of 6.7 correct answers. Group 3, which completed the process in a traditional classroom setting, had the lowest performance, with a 61% success rate for addition (an average of 6.1 correct answers) and a 49% success rate for subtraction (an average of 4.9 correct answers).

These results indicate a clear difference in success rates and arithmetic means across all groups for both types of operations. Specifically, Group 1 (Digital Educational Games) achieved the highest success percentage and arithmetic mean in both addition and subtraction. This suggests that students who worked with digital educational games were more successful in these operations. Group 2 (Educational Games) achieved a moderate level of success in both types of operations. Lastly, Group 3 (Traditional Methods) showed the lowest performance with the lowest success percentage and arithmetic mean.

3.2. Findings Related to the Second Sub-Problem

The findings regarding how the types of games contribute to students' sense of friendship are presented in Table 4.

Table 4. Themes Related to the Contribution of Game Types to Friendship

Theme	Digital Educational Games (Group 1)	F (n)	Educational Games (Group 2)	F (n)
Strengthening Friendship	Shared interests can strengthen friendships.	3	Friendship bonds become stronger.	3
Cooperation and Communication Skills	Team games increase cooperation.	2	Educational games improve cooperation and communication.	3
Increase in Social Interaction	Players of digital games may be good with technology but weak in face-to-face communication.	3	Players of educational games interact more.	3
Empathy and Emotional Intelligence	Digital-based games can increase empathy.	2	Educational games improve empathy.	3
Reflection in the Classroom	Game experiences can affect relationships in the classroom.	2	Educational games increase harmony in the classroom.	2
Negative Effects of Competition	Competition can create stress and negative emotions.	2	In educational games, cooperation is prioritized over competition.	3

According to Table 4, there are distinct differences in friendship relationships and social interaction between children who play digital educational games and those who play educational games. While digital educational games can positively influence children's friendships, the competitive nature of these games can sometimes lead to negative effects. Based on this finding, it can be argued that team-based games are more effective at developing children's cooperation and communication skills than individual digital games.

On the other hand, children who play educational games have stronger friendships and show a greater increase in social interaction compared to those who play digital games. Educational games may have contributed to the development of skills like cooperation and empathy by allowing children to participate more actively in group work. Additionally, the element of competition is less prominent in educational games compared to digital ones. This can lead to less stress and fewer negative emotions related to friendships.

Based on the findings in Table 4, while both types of games contribute to children's friendships in certain ways, educational games more strongly support children's face-to-face communication and cooperation. Digital educational games can facilitate communication on online platforms, but they may limit face-to-face interaction. Finally, it's clear that the game experiences are reflected in classroom friendships. The positive experiences children have during games help them become more harmonious and cooperative in the classroom environment.

4. Conclusion and Discussion

This research examined the effects of digital educational games and traditional educational games on students' basic operational skills of addition and subtraction, as well as the contributions of these tools to friendship relationships among students.

Based on the findings for the first sub-objective, the effect of digital educational games on academic achievement was greater compared to traditional educational games. It can be argued that students, born in the 21st century and living a life integrated with technology, feel more positive emotions towards digitized games and are therefore more successful. The basic operational skills education provided with traditional educational games was also more effective than the process conducted in traditional classrooms. In general, games are activities that diversify the teaching process. This finding of the research is consistent with other studies in the literature. For example, Habgood (2007) showed that digital game-based learning has a positive impact on students' academic achievement and

motivation. Similarly, Van der Ven, Segers, Takashima & Verhoeven (2017) concluded in their study with first-grade students that tablet-based education increases addition and subtraction fluency. Furthermore, Jarrah, Almassri, Johnson & Wardat (2022) found that digital-based games were effective in teaching students addition and subtraction. Likewise, this finding supports other studies on the use of digital games in mathematics. In their literature review on the effects of digital game-based learning in mathematics education, Serrano (2019) emphasized that such games generally enhance student engagement, while also exerting significant effects on collaboration and motivation. It has also been shown that digital educational games improve students' academic achievement in other subjects, such as Turkish language classes (Aşçı, 2019). In their study on the effect of using virtual manipulative math on iPads for young children's learning performance and efficiency, Moyer et al. (2015) observed that children's learning skills were positively influenced. Yiğit and Uzun (2022) demonstrated that children develop the ability to solve mathematical problems more effectively and increase their motivation through digital games. Similarly, the study by Uluçay and Çakır (2014) provided findings that interactive games increase students' motivation in mathematics class and can positively affect their cognitive performance while strengthening their interaction with the subject. Ünal and Kaya (2024) also stated in their research that digital games can be used as an effective tool for teaching math skills in early childhood.

To reveal the contribution of digital and traditional educational games to friendship among students, which was the second sub-objective of the research, interviews were conducted with the teachers who implemented the process. The data obtained from these interviews were analyzed. The results showed that educational games contributed more positively to friendship than digital educational games. Research indicates that educational games strengthen social bonds and improve collaboration skills among students (Buchs & Butera, 2015; Thi, 2025). Accordingly, the study found that traditional educational games contributed more to students' friendships than digital ones. This finding can be explained by the fact that educational games promote physical interaction and enable students to act together. The current findings also align with existing literature that supports the positive effects of educational games on student relationships (García & López, 2021).

Overall, the research findings demonstrate the positive effect of digital educational games on academic achievement and the role of educational games in strengthening social bonds. Digital educational games appear to be particularly effective in individual learning processes, increasing student motivation and positively impacting academic success. In this context, it can be said that traditional educational games and digital educational games are complementary learning tools, and when used in a balanced way in the educational process, they can support both academic achievement and social development.

5. Recommendations

Based on the research findings, the following recommendations are offered for the integration of games into the educational process:

Since digital educational games increase students' academic achievement, their integration into the educational process is recommended. However, to enhance students' social development, traditional educational games should also be included in the process. Therefore, a hybrid approach should be adopted, where both types of games are planned to be complementary to each other.

While digital educational games generally prioritize individual success and traditional educational games are thought to better foster friendship, digital educational games should be designed to facilitate more cooperation. Experts in educational technology should be encouraged to create digital educational games that guide students toward collaboration or can be played in groups.

Measures should be taken to enable teachers to use both digital and traditional educational games effectively when planning their lessons. Informative materials can be prepared to help teachers with the implementation process and ensure that the specified learning outcomes are met.

Both types of games should be included in the education curriculum for children aged 72-84 months from a pedagogical perspective, taking into account class levels. It is recommended that these be designed by considering not only the goal of academic achievement but also methods that ensure

social development.

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