



The Effect of Digital Game-Based Learning Applications on Students' Problem-Solving Skills and Attitudes Toward Social Studies: The Case of Minecraft Education¹

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Abstract

The aim of this study is to examine the effects of digital game-based learning applications on middle school students' attitudes toward the social studies course and their problem-solving skills. A quasi-experimental design, one of the quantitative research methods, was employed in the study. The research population consisted of 7th-grade students in Uşak, Turkey. The sample was selected through criterion sampling, and a school with a computer laboratory was chosen. The study included 36 students in the experimental group and 36 students in the control group. The Problem-Solving Skills Scale and the Social Studies Attitude Scale were used as data collection tools. The findings revealed that digital game-based learning had a positive and significant effect on students' problem-solving skills and their attitudes toward the social studies course.

Keywords: *Social studies, digital game-based learning, problem-solving, attitude, minecraft education*

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Introduction

Play is a fundamental activity present at every stage of human development. With the acceleration of digitalization, traditional forms of play have increasingly migrated to digital platforms, gaining a central role in individuals' lives. According to Aksoy (2014), digital games offer prolonged attention spans and high motivation, particularly among children.

In educational contexts, games offer multifaceted pedagogical benefits, such as facilitating learning, supporting experiential learning, fostering collaboration, and developing problem-solving skills (Prensky, 2001; Gee, 2003). These contributions make the integration of digital games into contemporary learning environments increasingly important. Today, primary school-aged children are extensively exposed to digital content, and their screen time is progressively increasing (Kardefelt-Winther, 2017). Consequently, leveraging the content and interactive power of digital tools to capture children's attention and engagement in lessons has become increasingly critical.

Digital games present effective tools for teachers in capturing students' attention and enhancing knowledge retention. Interactive game-based learning environments not only promote active participation but also contribute to the development of 21st-century skills such as collaboration, critical thinking, and creativity (Granic, Lobel, & Engels, 2014).

This is particularly important in courses like Social Studies, which are closely connected to everyday life. In such subjects, fostering students' positive attitudes toward the lesson and improving their problem-solving skills are key educational goals. However, traditional instructional methods outlined in the curriculum often fall short in achieving these objectives (Öztürk & Deveci, 2021). In this context, the interactive nature of digital game environments may support both cognitive and affective development in students (Wouters et al., 2012).

Play

Play is a natural and indispensable activity that supports both cognitive and affective skills throughout an individual's developmental processes. It stands out as an effective tool, especially in childhood, for acquiring essential life skills such as learning, exploration, and socialization (Aksoy, 2022). In educational settings, play encourages active participation in the learning process and facilitates lasting learning outcomes (Altunay, 2004).

Huizinga (1938) defines play as an activity based on voluntary participation, governed by certain rules, and characterized by elements of enjoyment; meanwhile, Piaget views play as a developmental tool that enables children to make sense of their surroundings. Play offers not only entertainment but also an important learning domain for developing higher-order skills such as learning, problem-solving, and creative thinking (Özer & Gürkan, 2006; Kocadağ, 2021).

Educationally structured games increase students' interest in lessons and enable holistic support for cognitive, affective, and social gains. In this respect, play has become an essential component of contemporary educational approaches.

Educational Games

Play is a natural learning tool that effectively influences both cognitive and social dimensions of development. From childhood onward, play plays a crucial role in helping individuals make sense of their environment, develop social roles, and reinforce problem-solving skills (Gander & Gardiner, 2001). Play involves active participation, is based on certain rules, and simultaneously encompasses creativity and freedom.

Educational games are instructional tools structured toward specific learning objectives, supporting active student participation and promoting lasting learning. These games direct students' attention to the lesson and enhance their interest and intrinsic motivation toward the learning process (Gömleksiz, 2013). Especially in disciplines like Social Studies, educational games activate students' thinking skills, enabling them to form conceptual connections and develop inquiry-based learning (Demir & Akpınar, 2018).

The impact of educational games on learning is not limited to knowledge transmission; they can also positively influence students' attitudes toward learning. Indeed, the ability to correct mistakes within game environments encourages students to engage more boldly in trial-and-error learning processes (Plass, Homer, & Kinzer, 2015). This fosters risk-taking tendencies in students, contributing to the development of positive attitudes toward learning (Gee, 2003).

For games to become effective learning tools, the tasks they contain must be appropriate to students' developmental levels, aligned with learning objectives, and supported by assessment tools (Toraman, Çelik, & Çakmak, 2018; Wouters et al., 2012). At this point, teacher guidance and pedagogical planning are critically important. A successful educational game transcends being merely an entertaining tool and transforms into a meaningful learning environment that enables students to actively engage with knowledge.

Digital Game-Based Learning

Digital games are games played via computers, tablets, or mobile devices that offer users visual, auditory, and interactive experiences. These games support cognitive skills such as problem-solving, decision-making, and strategy development by requiring active participation from the player (Gee, 2003; Vlachopoulos & Makri, 2017). The game content presents specific tasks and objectives to the user, transforming learning into both a personalized and experiential process.

Digital game-based learning refers to the integration of digital games into educational processes in a manner aligned with pedagogical objectives (Prensky, 2001; Kebritchi, Hirumi & Bai, 2010). The main goal of this approach is to make learning more attractive for students, increase their engagement in lessons, and support permanent learning. Especially for new generations growing up intertwined with technology, this method offers a more interactive and motivating alternative compared to traditional teaching approaches (Ersoy & Gürgen, 2021).

Research shows that digital game-based learning increases students' academic achievement, enhances problem-solving and other cognitive skills, and often improves motivation/attitudes when well-designed (Papastergiou, 2009; Tüzün et al., 2009; Wouters et al., 2013; Toraman, Çelik, & Çakmak, 2018). The feedback mechanisms provided within game environments enable students to monitor their own learning processes and correct their mistakes, thereby making the learning experience more effective.

Furthermore, digital games expose students to scenarios that simulate real-life situations. This approach supports not only knowledge acquisition but also higher-order thinking skills such as decision-making, outcome evaluation, and strategy development (Squire, 2011). The nature of educational games encourages active participation in the learning process, thereby fostering cognitive development.

Digital games also expose students to scenarios that simulate real-life situations. This approach supports not only knowledge acquisition but also higher-order thinking skills such as decision-making, outcome evaluation, and strategy development (Squire, 2011). The nature of educational games encourages active student engagement in the learning process, thereby fostering cognitive development.

However, effective digital game-based learning requires careful instructional design. A meaningful alignment between game content and curricular topics, with explicit attention to the target learners' age and developmental level, is supported by student game-design research (Baytak & Land, 2011; Baytak, Land, & Smith, 2011). It is also important to note that excessive use of digital games can lead to attention difficulties or risks of addiction.

In conclusion, digital game-based learning is regarded as a powerful learner-centered approach that supports student development in both cognitive and affective domains. Nevertheless, harnessing this potential effectively depends on selecting games based on sound pedagogical principles and integrating them appropriately into the teaching process.

Educational Use of MinecraftEdu in Digital Game-Based Environments

MinecraftEdu is a specialized version of the popular digital game Minecraft, designed for use in educational settings. This version includes simplified user interfaces, teacher control panels, lesson plans, and classroom management tools to facilitate the creation of interactive learning environments by students and teachers (Microsoft, 2020). Thanks to its highly customizable structure, MinecraftEdu supports the development of higher-order thinking skills such as creativity, collaboration, problem-solving, and critical thinking (Nebel, Schneider, & Rey, 2016).

The growing interest in digital game-based learning has paved the way for the integration of games like MinecraftEdu into educational contexts. Its open-ended design allows students to build their own virtual worlds and easily adapt task-based activities, making it a powerful pedagogical tool (Çakıroğlu & Gökoğlu, 2019). Furthermore, the integration of MinecraftEdu into classroom instruction with guided learning scenarios fosters the adoption of a learner-centered approach (Alkan & Koçak, 2022).

In the literature, MinecraftEdu has been found to be effectively used across various disciplines, particularly in science and mathematics education. For instance, Aydın and Ata (2024), in their systematic review, reported that digital game-based learning methods positively influence mathematics achievement, cognitive skills, and attitudes. Similarly, an educational digital game application developed by Ergun (2024) has been shown to enhance both academic achievement and motivation in science education, specifically in the topic of electricity transmission.

MinecraftEdu is especially notable in the context of Social Studies education for its impact on students' attitudes and motivation. Through task-based structures provided by the game, students become more engaged in Social Studies lessons and develop higher levels of motivation toward learning (Sarı & Karakuş, 2024).

This study structured the MinecraftEdu digital game environment within the Social Studies curriculum and investigated its effects on students' problem-solving skills and attitudes toward the course. During the implementation process, students completed tasks based on scenarios designed within the game, developed strategies to solve encountered problems, and experienced interactive learning. Thus, the educational potential of MinecraftEdu was evaluated not only theoretically but also practically, measuring the effects of digital game-based learning.

Developing Attitudes in Social Studies Through Digital Games

The Social Studies course aims to increase individuals' sensitivity to social issues, foster citizenship awareness, and introduce cultural values. However, students' attitudes toward the course are a crucial determinant in achieving these objectives. Students' interest in Social Studies directly affects their level of participation and motivation for learning. Digital game-based learning, with its interactive and enjoyable nature, keeps this interest alive; problem scenarios, reward systems, and visual narratives within the games support students in developing positive attitudes toward the course.

Research has shown that in-class applications of digital games foster positive attitudes toward Social Studies among students. Particularly, configurable digital games like Minecraft have been emphasized for encouraging voluntary student participation in the learning process and making the learning experience more meaningful (Sarı & Karakuş, 2024).

Enhancing Problem-Solving Skills in Social Studies Through Digital Games

Problem-solving skill refers to an individual's ability to develop appropriate strategies and generate solutions for complex situations. Among the Social Studies curriculum objectives are goals such as evaluating events through cause-and-effect relationships, making decisions, and developing different perspectives, all of which directly support the development of this skill (Kaçar, 2023). In digital game environments, students face fictional but real-life related problems and actively engage in problem-solving processes. Digital games like MinecraftEdu provide students with scenario-based tasks that support higher-order thinking skills such as analytical thinking, problem-solving, and decision-making. Studies conducted in this context have indicated that digital game-based instructional applications significantly improve students' problem-solving skills (Uluay, 2017).

Purpose of the Study

Play is a natural learning tool that supports individuals' cognitive, social, and affective development. With the integration of technology into daily life, digital games have evolved from mere entertainment tools into effective educational strategies. Especially for children, digital games increasingly play a role in fostering higher-order thinking skills such as problem-solving, decision-making, and self-regulation.

This study aims to provide original, practice-oriented data by experimentally examining the effects of digital game-based learning in the context of social studies education. The findings are expected to contribute to the field by informing curriculum updates, improving instructional strategies, and promoting the broader integration of game-based learning environments.

Specifically, the purpose of this research is to examine the impact of digital game-based learning applications on middle school students' attitudes toward the social studies course and their problem-solving skills. Within this scope, a digital game environment developed using the Minecraft Education platform was implemented to evaluate its effects on 7th-grade students' attitudes and problem-solving abilities through a quasi-experimental design.

The research questions guiding the study are as follows:

1. Is there a statistically significant difference between the pre-test and post-test scores of the experimental group regarding problem-solving skills after participating in the digital game-based learning intervention?
2. Is there a statistically significant difference between the pre-test and post-test scores of the experimental group regarding attitudes toward the social studies course after participating in the digital game-based learning intervention?

Method

Research Design

This study was conducted within the scope of a quasi-experimental design, one of the quantitative research methods. In the experimental process, a pretest–posttest control group design was utilized to examine the effects of digital game-based learning applications on students' problem-solving skills and their attitudes toward the social studies course. A quasi-experimental nonequivalent-groups design was adopted because intact, pre-existing classes were used and random assignment was not feasible (Price, Jhangiani, & Chiang, 2015; Campbell & Stanley, 1963).

Population and Sample

The sample of the study consisted of 72 seventh-grade students enrolled in a public middle school in the province of Uşak during the 2024–2025 academic year. Criterion sampling was used in the selection of the school. A school with a computer laboratory in Uşak was identified based on this criterion. Students were divided into experimental ($n = 36$) and control ($n = 36$) groups. Pretest analyses confirmed that there was no significant difference between the groups at the initial level.

Data Collection Tools

Two distinct measurement tools were utilized in this study:

Problem-Solving Skills Scale: This scale was developed to assess students' problem-solving competencies in an academic context. Its validity and reliability studies were previously conducted, and the Cronbach's alpha coefficient was reported as .84.

Social Studies Attitude Scale: This tool was used to determine students' interest, motivation, and overall attitudes toward the social studies course. The Cronbach's alpha reliability coefficient of the scale was reported as .87.

Both the Problem-Solving Skills Scale and the Social Studies Attitude Scale were administered to the experimental and control groups as pre-tests and post-tests.

Implementation Process

The experimental group was instructed through a digital game-based learning program designed for eight weeks. During this process, scenarios aligned with the objectives of the social studies curriculum were implemented via the MinecraftEdu platform. Students engaged in interactive tasks that required them to apply skills such as problem-solving, decision-making, and collaboration.

In contrast, the control group received instruction on the same curriculum objectives through traditional teaching methods as outlined in the national curriculum. The same teacher conducted instruction for both groups to ensure instructional consistency, and efforts were made to control external variables throughout the process.

Data Analysis

The collected data were analyzed using statistical software. Initially, the normality of the data distribution was tested using the Shapiro–Wilk test. Since the data did not follow a normal distribution, non-parametric statistical methods were employed in the analysis.

The Mann–Whitney U Test was used to compare pre-test and post-test scores between the experimental and control groups.

The Wilcoxon Signed-Rank Test was applied to evaluate within-group (pre-test vs. post-test) progress.

For all analyses, the significance level was set at $p < .05$. The findings were reported along with U and Z statistics obtained from the relevant tests.

Findings

Findings Related to Problem-Solving Skills

In the first step of the analysis, the pre-intervention levels of problem-solving skills of the experimental and control group students were compared. According to the results of the Shapiro–Wilk normality test, the data for the experimental group did not follow a normal distribution ($W = 0.87$, $p = .001$); therefore, non-parametric statistical tests were preferred for further analysis. The Mann–Whitney U test revealed that the mean pre-test score for the experimental group was 74.78 ($SD = 9.17$), while the mean for the control group was 74.92 ($SD = 9.22$). This result indicates no statistically significant difference between the two groups prior to the intervention ($U = 646.0$, $p = .987$), suggesting that both groups were equivalent in terms of problem-solving skills at the beginning of the study.

The first sub-research question was stated as: “Is there a statistically significant difference between the pre-test and post-test scores of the experimental group who participated in the digital game-based learning intervention in terms of problem-solving skills?” The results of the Wilcoxon Signed-Rank Test, conducted to compare the pre-test and post-test scores of the experimental group, are presented in Table 1:

Table 1
Comparison of Problem-Solving Scores by Group

Group	Test Type	Mean(SD)	Z Value	p Value
Experimental	Pre-Test	74.78 (9.17)	-	-
Experimental	Post-Test	82.94 (8.37)	-3.059	.002
Control	Pre-Test	74.92 (9.22)	-	-
Control	Post-Test	75.00 (8.88)	-0.136	.892

The problem-solving skill levels of the experimental group before and after the intervention were analyzed using the Wilcoxon Signed-Rank Test. The pre-test mean score was 74.78, while the post-test mean increased to 82.94 (SD = 8.37). The test results yielded $Z = -3.059$, $p = .002$, indicating that this increase was statistically significant. This finding suggests that the digital game-based learning intervention had a positive effect on the students' problem-solving skills.

On the other hand, no significant difference was found in the control group's problem-solving scores between the pre-test and post-test. The mean scores were 74.92 and 75.00, respectively, with a Wilcoxon test result of $Z = -0.136$, $p = .892$. This indicates that the traditional teaching approach did not lead to a meaningful improvement in students' problem-solving abilities.

Findings Related to Attitudes Towards the Social Studies Course

When the pre-test scores of the attitude scale for the experimental and control groups were compared, no statistically significant difference was found between the groups. The pre-test mean score of the experimental group was calculated as 80.81 (SD = 7.92), while that of the control group was 80.64 (SD = 8.44).

The Shapiro–Wilk normality test indicated that the data for the experimental group did not follow a normal distribution ($W = 0.88$, $p = .001$). Therefore, non-parametric tests were preferred for comparisons. According to the results of the Mann–Whitney U test, no significant difference was found between the groups ($U = 646.0$, $p = .987$; $p > .05$). This finding suggests that both groups had similar levels of attitude toward the social studies course before the intervention, supporting the internal validity of the study.

The second sub-problem of the study was stated as: “Is there a significant difference between the pre-test and post-test attitude scores of the experimental group participating in the digital game-based learning intervention?” The values obtained from the analysis of the data collected during the study, showing the attitude scores of the groups, are presented in Table 2;

Table 2
Comparison of Attitude Scores Towards the Social Studies Course by Groups

Group	Test Type	Mean(SD)	Z Value	p Value
Experimental	Pre-Test	80.81 (7.92)	-	-
Experimental	Post-Test	85.56 (8.32)	-4.167	.001
Control	Pre-Test	80.64 (8.44)	-	-
Control	Post-Test	81.11 (8.02)	-0.762	.446

The social studies course attitude levels of students in the experimental and control groups were compared before and after the implementation. The pre-test mean score of the experimental group was 80.81 (SD = 7.92), and the post-test mean score was 85.56 (SD = 8.32). According to the results of the Wilcoxon Signed-Rank Test, the difference was statistically significant ($Z = -4.167$, $p < .001$). This finding indicates that digital game-based learning significantly improved students' attitudes towards the social studies course.

For the control group, the pre-test mean was 80.64 (SD = 8.44) and the post-test mean was 81.11 (SD = 8.02). The Wilcoxon test result ($Z = -0.762$, $p = .446$) showed no statistically significant change in the students' attitudes.

Additionally, when the post-test results of the experimental and control groups were compared, the Mann–Whitney U test revealed a statistically significant difference ($Z = -2.170$, $p = .030$). This result suggests that students who participated in the digital game-based learning process developed more positive attitudes towards the social studies course compared to those who received instruction through traditional methods.

Conclusion and Discussion

This study comprehensively examined the effects of digital game-based learning on both problem-solving skills and attitudes toward the Social Studies course. The findings indicate that digital games provide dual benefits for middle school students. Students in the experimental group not only

improved their problem-solving abilities but also demonstrated more positive attitudes toward the course. This outcome suggests that digital games support affective components in addition to cognitive gains within educational processes (Uluay, 2017; Sarı & Karakuş, 2024).

The target group of the study—7th-grade students—are transitioning from concrete operational to formal operational stages of cognitive development, making them particularly receptive to interactive and motivating learning environments. In this context, digital games encouraged active participation and transformed learning into an enjoyable and meaningful experience. Similarly, a study conducted by Koç Aras and Karslı Baydere (2025) found that scenario-supported game-based activities fostered students' enthusiasm and interest toward the course.

On the other hand, the effectiveness of digital games as learning tools depends on their careful design aligned with pedagogical objectives and their integration into the curriculum. Some studies in the literature emphasize that games focusing solely on competition or lacking strong pedagogical foundations fail to achieve desired learning outcomes (Byun & Joung, 2018; Talan & Kalinkara, 2020). The game environment used in this study was content-structured, designed around characters and tasks, integrated with the learning process, and implemented in a way that supports students' cognitive and affective interactions.

This study demonstrated that digital games positively influence not only cognitive achievement but also student motivation and attitudes toward the course. This finding suggests that digital games can serve as powerful learning tools that enrich learning, capture students' attention, and promote active participation—not merely as entertainment. When compared with similar studies in the literature, the results of this research align with national and international trends.

In conclusion, this study fills a gap in the field by showing that digital game-based learning can simultaneously contribute to both cognitive and affective gains. Future research involving different age groups, various subject areas, and long-term implementations will further deepen our understanding of the effects of digital games in education. Particularly, studies focusing on sub-dimensions of problem-solving (e.g., strategy development, creativity) and components of attitude (e.g., interest in learning, self-confidence) are recommended. Moreover, mixed-method research supported by qualitative data may provide more comprehensive insights into students' digital game experiences.

Digital game-based learning is considered one of the next-generation approaches in education, holding the potential to cultivate individuals with strong problem-solving skills and a keen willingness to learn. In this regard, it is regarded as a powerful instructional strategy that can contribute not only to today's educational understanding but also to the future of education.

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Ethical Declaration and Committee Approval

In this research, the principles of scientific research and publication ethics were followed.

Proportion of the Author Contribution

Researchers contributed equally to this study.