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Teacher candidates' intention to teach 21st century skills with digital games: A survey research

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Highlights:

- Digital games foster critical thinking, creativity, collaboration, and digital literacy in education.
- Gender and academic department significantly influence students' digital gaming behaviors and engagement levels.
- Teacher candidates prefer cognitively demanding games emphasizing problem-solving and strategic thinking.
- Gaming enhances future teachers' creativity, critical thinking, and technical proficiency.

Abstract

Integrating digital games into educational contexts has become a growing area of research and practice. Digital technologies — including digital games — play a critical role in supporting the development of these skills. Interactive environments foster critical thinking, problem-solving, collaboration, and adaptability by engaging learners in meaningful, complex tasks. Moreover, digital platforms can facilitate self-directed learning, allowing learners to choose, plan, and reflect on their educational journeys. This study adopts a survey research design to explore teacher candidates' intentions on using digital games for teaching 21st-century skills via demographic and motivational variables, including preferences and engagement. Findings suggest that gender and academic department have a significant influence on students' digital game-playing behaviors. Overall, the data highlight that intrinsic motivations, such as personal enjoyment, emotional regulation, and leisure, were more prevalent than extrinsic or social motives. In conclusion, the findings indicate that playing digital games is associated with higher levels of creativity, critical thinking, research skills, and technological proficiency among pre-service teachers. However, no significant differences were observed in communication and digital citizenship skills. These results suggest that digital games could be strategically integrated into teacher education programs to support the development of specific critical 21st-century skills.

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Introduction

Digital games in educational settings have gained considerable attention in both research and practice. Digital games, defined as electronic games played on computers, consoles, or mobile devices, may be created explicitly for educational purposes (serious games) or adapted from commercial products (Arnab et al., 2015). Within education, game-based learning (GBL) refers to using games to achieve instructional goals (Prensky, 2001). GBL approaches typically integrate elements such as competition, rewards, problem-solving, storytelling, and collaboration to enhance learners' engagement with content. Closely related is the concept of gamification, which entails the application of game elements (e.g., badges, points, leaderboards, levels) in non-game contexts, such as classrooms, to increase motivation and participation (Deterding et al., 2011; Sümer & Aydın, 2022). Unlike GBL, which directly employs games to facilitate learning, gamification requires integrating game design elements into non-game contexts to make these contexts more engaging. In this regard, GBL focuses on using games to strengthen educational processes, whereas gamification emphasizes adapting playful mechanics outside gaming environments (Sümer & Aydın, 2018).

According to the literature, digital games have several benefits in education. First, digital games have been shown to enhance student motivation and engagement by providing immersive, interactive learning environments (Gee, 2003). Games naturally align with constructivist learning theories, encouraging students to build knowledge actively through experimentation and discovery (Sümer, 2021). Also, digital games frequently balance encouraging collaboration among players with encouraging individual success (Arslankara, 2025), which is similar to our educational system. Additionally, they can promote problem-solving skills, critical thinking, and collaborative learning, called 21st-century or soft skills, when students work together in multiplayer or team-based environments (Squire, 2011).

However, despite these benefits, there are notable challenges and limitations to using digital games in educational settings. Teachers often face barriers such as the lack of access to appropriate technological resources, insufficient training to integrate games effectively, and curricular constraints prioritizing standardized testing over innovative teaching methods (Young et al., 2012). Furthermore, ongoing debates exist regarding the educational validity of digital games, as well as concerns about screen time and game addiction (Granic et al., 2014). Digital games offer significant potential for transforming educational practices when thoughtfully integrated.

21st Century Skills

21st-century skills refer to a broad set of knowledge, skills, work habits, and character traits essential for success in today's rapidly changing, technology-driven world. These skills extend beyond traditional academic content and focus on preparing individuals for complex life and work environments (Trilling & Fadel, 2009).

Several educational frameworks have defined 21st-century skills, the most prominent being the Partnership for 21st Century Learning (P21), which identifies key categories:

- Learning and Innovation Skills: Creativity and innovation, critical thinking and problem solving, communication, and collaboration.
- Information, Media, and Technology Skills: Information, media, and ICT literacy.
- Life and Career Skills: Flexibility, initiative, social and cross-cultural skills, productivity, and leadership (P21, 2019).

Similarly, the OECD's Learning Compass 2030 emphasizes competencies such as critical thinking, co-operation, self-regulation, and digital literacy as necessary for lifelong learning and active citizenship (OECD, 2019).

Digital technologies – including digital games – play a critical role in supporting the development of these skills. Interactive environments foster critical thinking, problem-solving, collaboration, and adaptability by engaging learners in meaningful, complex tasks. Moreover, digital platforms can facilitate self-directed learning, allowing learners to choose, plan, and reflect on their educational journeys (Voogt & Roblin, 2012).

Digital Games as Tools for Teaching 21st Century Skills

Digital games offer dynamic and interactive environments that can naturally support the development of 21st-century skills. Numerous studies have explored how games contribute to cultivating skills such as critical thinking, creativity, collaboration, communication, and digital literacy (An & Cao, 2017; Checa-Romero & Gimenez-Lozano, 2025; Kahila et al., 2020; Qian & Clark, 2016).

One of the key advantages of digital games is their ability to promote critical thinking and problem-solving. Many games require players to analyze complex situations, make strategic decisions, and adapt to new information, thus aligning well with critical thinking objectives (Gee, 2003). Puzzle, strategy, and simulation-based games foster higher-order thinking by challenging learners to plan, hypothesize, experiment, and reflect. Creativity is another skill frequently nurtured through digital gameplay. Games that involve world-building (e.g., Minecraft), storytelling (e.g., interactive fiction games), or design (e.g., Roblox Studio) offer learners opportunities to engage in open-ended, imaginative problem-solving (Hsiao et al., 2014). Such platforms encourage students to create, innovate, and share, central aspects of 21st-century learning. Communication and collaboration are also highly emphasized in multiplayer and team-based games. Cooperative games often require players to share information, negotiate strategies, divide roles, and work towards common goals, fostering interpersonal skills and social learning (Voulgari et al., 2014). Online collaborative environments mimic real-world professional settings, helping students to practice collaboration in digital contexts. Moreover, digital games enhance digital literacy by immersing students in technology-rich environments. Players learn to navigate digital interfaces, manage information, and develop a critical awareness of media and digital content (Steinkuehler & Duncan, 2008). Research has also shown that well-designed educational games can improve self-directed learning, resilience, and adaptability – important life and career skills (Whitton, 2010). Games promote perseverance and iterative learning, enabling learners to experience both failure and success in a safe environment.

However, the effectiveness of digital games in teaching 21st-century skills depends heavily on several factors, such as the game's design, the pedagogical strategies employed by teachers, and the context in which the game is used (Plass et al., 2015). Introducing games into classrooms is not enough; intentional integration, aligned with learning objectives, is crucial.

In summary, digital games hold significant potential as powerful tools for teaching and fostering 21st-century skills. When used thoughtfully, they can transform passive learning into active, student-centered experiences that prepare learners for the complexities of modern life.

Teacher Candidates' Perspectives on Digital Games for Teaching 21st Century Skills

The successful integration of digital games into educational practice relies heavily on teachers' attitudes, beliefs, and readiness, particularly future educators in teacher education programs. Teacher candidates' perspectives are crucial because they influence whether and how they will incorporate innovative tools, such as digital games, into their future classrooms (Ertmer, 2005).

Research suggests that while many teacher candidates recognize the potential of digital games to enhance learning and develop 21st-century skills, their actual confidence and willingness to use games in teaching varies significantly. Several studies indicate that teacher candidates are generally positive about using games for education. They often perceive games as tools that boost student motivation, engagement, collaboration, and critical thinking (Bourgonjon et al., 2010; Kenny & Gunter, 2011).

However, this generally positive perception is often influenced by several moderating factors. Experience with digital games plays a significant role: candidates who frequently engage with digital games tend to hold more favorable attitudes toward their educational use (Ertzberger, 2009). Regarding knowledge and skills, many teacher candidates report feeling unprepared to effectively select, implement, or design game-based learning experiences, mainly due to limited exposure during their teacher education programs (Can & Cagiltay, 2006). Additionally, perceived challenges—such as concerns over classroom management, unequal access to technology, difficulty aligning games with curriculum objectives, and fears of distraction—further contribute to hesitation in adopting digital games (Marone & Strudler, 2015).

Institutional factors also play a critical role. The lack of emphasis on digital pedagogy within many teacher education curricula limits candidates' readiness to integrate games meaningfully into instruction. Without sufficient modelling or hands-on experiences during their training, teacher candidates often remain reluctant to view digital games as legitimate pedagogical tools (Tondeur et al., 2012). Notably, studies have found that when teacher candidates are exposed to structured training, successful case studies, or practical opportunities to use games in lesson planning, their confidence and willingness to adopt game-based methods significantly increase (Denham et al., 2016). These findings highlight the importance of targeted interventions in teacher education for promoting more informed and proactive attitudes toward integrating digital games.

In conclusion, while teacher candidates generally acknowledge the potential of digital games to support the development of 21st-century skills, actual implementation is still hindered by gaps in knowledge, experience, and institutional support. Understanding these perspectives is crucial for

developing teacher education programs that effectively and meaningfully prepare future educators to integrate digital games into their teaching practice.

The literature provides substantial theoretical and empirical support for integrating digital games in education, particularly for fostering 21st-century skills such as critical thinking, creativity, collaboration, communication, and digital literacy. Digital games create interactive and engaging environments that promote cognitive and social competencies vital for success in contemporary society. Nevertheless, the effectiveness of these tools largely depends on teacher candidates, whose role is central in translating this potential into practice. Although many prospective educators acknowledge the advantages of digital games, factors such as insufficient training, limited experience, and institutional constraints continue to restrict their ability to implement game-based approaches effectively. Moreover, existing studies highlight important gaps, including the need for more skill-specific investigations and a clearer understanding of how teacher education programs can effectively prepare candidates for game-based learning. Addressing these gaps is crucial for advancing the integration of digital games in developing 21st-century skills and equipping future teachers to innovate within their classrooms.

Those research questions were sought to address these gaps.

1. To what extent do gender and academic department influence the digital gaming behaviours of teacher candidates?
2. What are the game genre preferences of teacher candidates who engage in digital gaming?
3. What are the preferred device types among teacher candidates who engage in digital gaming?
4. What are the primary motivations for engaging in digital gaming?
5. What are the primary reasons for non-engagement in digital gaming?
6. To what extent do gender and academic department influence participants' evaluations of digital game elements?
7. To what extent does the perception of whether 21st-century abilities can be taught through digital games differ based on the gaming experiences of teacher candidates?

METHOD

This study adopts a survey research design to explore teacher candidates' intentions on using digital games for teaching 21st-century skills via demographic and motivational variables, including preferences and engagement.

Research Design

Survey research represents a particular type of field study in which data are collected from a sample systematically drawn from a clearly defined population through structured questionnaires (Visser et al., 2000). As Pinsonneault and Kraemer (1993) noted, surveys effectively gather information regarding large populations' characteristics, behaviors, or opinions. In addition, surveys are frequently employed to identify needs, analyze trends in demand, and explore possible impacts within a specified target group (Salant & Dillman, 1994).

Participants and Procedure

The data for this study were collected through a survey developed by the researcher. The survey consisted of three sections: (a) demographic information about the teacher candidates, (b) participants' digital game preferences, and (c) teacher candidates' perspectives on the use of digital games for teaching 21st-century skills. The third section also included items designed to assess participants' views on how digital games contribute to specific 21st-century skills.

Before administering the survey, participants were informed about the purpose of the study, and their informed consent was obtained. Data collection took place during the Fall 2019 semester and was conducted across three public universities in Turkey. In total, 423 teacher candidates voluntarily completed the survey instrument. More demographic data can be seen in Table 1.

Data Collection Tool and Analyses

A self-developed survey instrument was designed as the primary data collection tool to investigate teacher candidates' intentions regarding using digital games to teach 21st-century skills. A comprehensive literature review informed the development process on digital game-based learning, 21st-century skills, and motivational theories relevant to digital games in education. The survey included items targeting

demographic characteristics and motivational variables such as preferences and engagement in educational settings. Although the instrument was contextually grounded and theoretically informed, detailed procedures for establishing its validity and reliability have not been disclosed. Consequently, while the survey provides initial insights into emerging trends and relationships, caution should be exercised when generalizing the results. Further research is recommended to subject the instrument to rigorous evaluation.

To ensure content validity, the survey items were developed by extensively reviewing the literature on digital games, game-based learning, and 21st-century skills frameworks. An initial item pool was generated and subsequently reviewed by a panel of three experts in educational technology and teacher education, who evaluated the items regarding clarity, relevance, and representativeness. Based on their feedback, redundant or ambiguous items were revised or removed. Expert review is one of the ways to ensure content validity. Expert reviewers assess each item to judge its clarity, relevance, and coverage of the intended construct, ensuring that the instrument reflects the domain of interest (Boateng et al., 2018).

FINDINGS

In this part, findings were presented based on research questions.

Table 1. Cross-tabulation of Gender, Department, and Digital Gaming Status

		Digital Gaming		
Gender	Department	No	Yes	Total
Female	Early Childhood Education	23	50	73
	Science Education	18	52	70
	Primary Education	12	24	36
	Turkish Education	6	8	14
	Mathematics Education	10	42	52
	Computer Education and Instructional Tech.	15	32	47
Male	Early Childhood Education	0	8	8
	Science Education	1	18	19
	Primary Education	0	10	10
	Turkish Education	0	4	4
	Mathematics Education	2	23	25
	Computer Education and Instructional Tech.	5	60	65
Total		92	331	423

Table 1 presents the distribution of digital gaming behavior across gender and academic departments. The analysis revealed notable gender and departmental differences in digital gaming behaviors among teacher candidates. Female participants reported lower digital gaming rates than their male peers across most departments. Male teacher candidates were particularly more engaged with digital games in departments including Computer Education and Instructional Technologies (CEIT) and Mathematics Education. The highest number of gamers, regardless of gender, was observed in the CEIT department, where 92 students indicated they played digital games. Mathematics Education also demonstrated relatively high engagement, especially among male participants. Conversely, Turkish Education recorded the lowest number of digital gaming, reflecting minimal interest in gaming among these participants. Broadly, digital gaming was more prevalent among students from technology- and mathematics-oriented departments, while those from traditional education programs—such as Early Childhood Education and Turkish Education—were less likely to engage with digital games. These trends suggest that gender and academic departments influence digital gaming habits, potentially due to varying levels of exposure to technology, personal interest in digital media, or beliefs about the pedagogical relevance of games to their future teaching careers.

Table 2. Participants' Digital Gaming Status by Game Genre (n=331)

Game Genre	Option	f	%
Action	No	185	55.9
	Yes	146	44.1
Adventure	No	189	57.1

Game Genre	Option	f	%
Fighting	Yes	142	42.9
	No	249	75.2
Platform	Yes	82	24.8
	No	292	88.2
Puzzle	Yes	39	11.8
	No	145	43.8
Intelligence	Yes	186	56.2
	No	100	30.2
Simulation	Yes	231	69.8
	No	252	76.1
Role-Playing	Yes	79	23.9
	No	294	88.8
Sports	Yes	37	11.2
	No	214	64.7
Strategy	Yes	117	35.3
	No	189	57.1
Logical	Yes	142	42.9
	No	192	58.0
Mathematics	Yes	139	42.0
	No	250	75.5
Educational	Yes	81	24.5
	No	168	50.8
	Yes	163	49.2

Table 2 shows the distribution of participants' engagement in different game genres. The distribution of participants' digital game preferences reveals several important trends. The most frequently played genres were those emphasizing cognitive engagement. Intelligence games had the highest participation rate, with 69.8% of participants reporting engagement. This was followed by puzzle games (56.2%) and educational games (49.2%), indicating a strong interest in game types that support problem-solving and learning. In contrast, role-playing games (RPGs) and platform games had the lowest levels of engagement, at 11.2% and 11.8%, respectively. Other, less frequently played genres included fighting games and mathematics games, each played by only 24–25% of respondents. Additionally, simulation games, often associated with real-world modeling or scenario-based learning, were played by just 23.9%, suggesting that more realistic or experiential formats were less appealing to this sample. Participants generally showed greater interest in cognitively demanding games than action-oriented or recreational genres. The predominance of "No" responses across most genres supports this trend, though educational games showed a relatively balanced distribution of interest. These findings may reflect the sample's demographic profile—likely composed of pre-service teachers—and their inclination toward games perceived as educational, intellectually stimulating, or relevant to their academic and professional development.

Table 3. Participants' Digital Gaming Status by Device Preferences

Device	No (n, %)	Yes (n, %)
PC	232 (70.1%)	99 (29.9%)
Laptop	144 (43.5%)	187 (56.5%)
Smartphone	34 (10.3%)	297 (89.7%)
Tablet	241 (72.8%)	90 (27.2%)
PlayStation	241 (72.8%)	90 (27.2%)
Xbox	320 (96.7%)	11 (3.3%)

An analysis of device preferences for digital gaming among participants (n = 331) revealed distinct patterns across various platforms. Smartphones were the most commonly used gaming device, with 89.7% of respondents indicating they played games on their phones. This result highlights the central role of

mobile technology in contemporary gaming behavior, likely due to the accessibility, affordability, and convenience of smartphones. Laptops were the second most popular device, with 56.5% of participants reporting gaming activity on these devices. In contrast, only 29.9% of participants reported using desktop PCs for gaming, suggesting a shift away from traditional computing devices in favor of more portable options.

Tablet usage was relatively limited, with 27.2% of respondents indicating gaming on this platform. Similarly, gaming console use was modest. PlayStation was used by 27.2% of the sample, while Xbox consoles had the lowest usage rate, at only 3.3%. These results suggest that although consoles remain established platforms in the gaming industry, their role among this particular group—presumably composed of university students or pre-service teachers—is considerably overshadowed by mobile and laptop gaming.

Table 4. The Analysis of Participants' Motivations for Engaging in Gaming

Reason	No (n, %)	Yes (n, %)
To have fun	62 (18.7%)	269 (81.3%)
To compete and seek challenges	171 (51.7%)	160 (48.3%)
To relieve boredom	74 (22.4%)	257 (77.6%)
To communicate with others	297 (89.7%)	34 (10.3%)
To relieve stress	116 (35.0%)	215 (65.0%)
To make friends and empathize with others	306 (92.4%)	25 (7.6%)

Analyzing participants' motivations for engaging in digital gaming revealed several dominant patterns. The most frequently reported motive was fun, with 81.3% of participants indicating playing games primarily for enjoyment. Similarly, relieving boredom was a highly endorsed reason, cited by 77.6% of respondents. These findings suggest that entertainment and diversion are central drivers of gaming behaviour among the sample.

Stress relief emerged as another key factor, with 65.0% of participants reporting playing games to manage or reduce stress. While less prominent, competitive motives were still noteworthy: 48.3% of participants indicated playing games to seek challenges or engage in competition, reflecting a moderate interest in achievement-oriented gaming.

In contrast, social motivations were considerably less influential. Only 10.3% of participants reported playing games to communicate with others, and just 7.6% indicated playing to make friends or empathize with fellow players. These results suggest that, for this group, gaming is predominantly a solitary activity rather than a socially driven one.

Overall, the data highlight that intrinsic motivations—such as personal enjoyment, emotional regulation, and leisure—were more prevalent than extrinsic or social motives. This trend aligns with broader patterns observed in casual or mobile gaming, where convenience and personal gratification often outweigh competitive or community-based engagement.

Table 5. The Analysis of Participants' Reasons for Non-Engagement in Gameplay

Reason	No (n, %)	Yes (n, %)
Lack of interest	28 (30.8%)	63 (69.2%)
Waste of time	49 (53.8%)	42 (46.2%)
Lack of time to play games	68 (74.7%)	23 (25.3%)
Lack of knowledge about how to play games	88 (96.7%)	3 (3.3%)
Lack of necessary equipment to play games	82 (90.1%)	9 (9.9%)

The analysis of participants who reported not playing digital games (n = 91) revealed several reasons for non-engagement. The most frequently cited reason was a lack of interest, with 69.2% of respondents indicating that digital games did not appeal to them. This suggests that intrinsic motivation is crucial in determining engagement with digital gaming activities. Another notable reason was the perception that playing digital games constitutes a waste of time, endorsed by 46.2% of participants. This finding highlights the potential stigma associated with gaming, where it may be perceived as unproductive or frivolous, particularly among individuals with competing demands or different leisure preferences.

A substantial proportion of participants (25.3%) reported a lack of time as a barrier to playing digital games. This aligns with broader trends indicating that adults and working individuals often deprioritize gaming due to academic, occupational, or familial responsibilities.

Technical and knowledge-based barriers were less frequently reported. Only 3.3% of respondents cited a lack of knowledge about how to play digital games as a deterrent, and 9.9% indicated that the absence of necessary gaming equipment prevented their participation. These findings suggest that, while access and skills can be barriers for a small subset of individuals, psychological and attitudinal factors (such as interest and perceived value) play a more decisive role in influencing gaming behaviors among non-players.

Overall, the results emphasize that motivational and value-related factors are more significant than logistical or technical barriers in explaining why some individuals choose not to engage with digital games. Future research could investigate how demographic variables, such as age, education level, and cultural attitudes, influence these perceptions.

Table 6. Independent Samples t-Test Results for Game Elements and Gender

Game Element	Male (M ± SD)	Female (M ± SD)	t	p
Communication with Others	4.14 ± 0.84	3.23 ± 1.09	-7.92	< .001*
Winning the Game	-	-	-0.32	.748
Infinitive Lives	-	-	-1.17	.243
Choosing an Avatar	3.77 ± 1.04	3.33 ± 1.04	-3.77	< .001*
Challenges	-	-	-0.75	.454
Leaderboard	-	-	-0.92	.359
Badges	-	-	-0.23	.818

An independent samples t-test was conducted to compare teacher candidates' perceptions of various game elements by gender. The results revealed a statistically significant difference between females and males for Communication ($t(329) = -7.923$, $p < .001$) and Avatar ($t(329) = -3.768$, $p < .001$). Males reported significantly higher scores for these game elements compared to females.

No significant gender differences were found for other game elements ($ps > .05$). These findings suggest that while some aspects of game design may be more appealing or engaging to male participants, other game elements appear to be perceived similarly across genders.

Table 7. One-Way ANOVA Results for Department Differences

Game Element	$F(df_1, df_2)$	p	η^2 (Effect Size Estimate)
Communication with Others	6.40(5, 325)	< .001*	.090 (moderate)
Winning the Game	0.79(5, 325)	.560	–
Infinitive Lives	0.68(5, 325)	.639	–
Choosing an Avatar	1.49(5, 325)	.192	–
Challenges	0.67(5, 325)	.647	–
Leaderboard	0.69(5, 325)	.635	–
Badges	0.25(5, 325)	.941	–

A one-way ANOVA was used to explore differences in perceptions of game elements across six academic departments. A statistically significant effect of department was found for Communication, $F(5, 325) = 6.40$, $p < .001$, $\eta^2 = .090$, indicating a moderate effect size (Cohen, 1988). Findings revealed that Computer Education and Instructional Technologies (CEIT) department students rated the Communication element significantly higher than students from several other departments.

No significant departmental differences were observed for the remaining game elements ($ps > .05$), suggesting that preferences for most game elements are consistent across academic backgrounds, except the Communication element.

The findings prove that gender and academic background influence students' perception of certain game design elements. Specifically, the Communication element—which may represent a more competitive or achievement-oriented feature—was rated higher by males and CEIT students, possibly reflecting different motivational profiles. These insights can inform the design of educational games to ensure they cater to diverse learner groups without reinforcing gender or disciplinary biases.

Table 8. Independent Samples t-Test Results for Teacher Candidates' Intentions to Teach 21st Century Skills with Digital Games

Skill Area	Players (M ± SD)	Non-Players (M ± SD)	t	p
Creativity	3.80 ± 0.998	3.47 ± 0.981	-2.79	.006

Critical Thinking	3.79 ± 0.921	3.44 ± 0.945	-3.16	.002
Technological Proficiency	3.72 ± 0.993	3.44 ± 0.957	-2.37	.018
Research Skills	3.66 ± 1.019	3.41 ± 1.075	-2.07	.040
Communication Skills	3.67 ± 0.961	3.54 ± 0.966	-1.57	.117
Digital Citizenship	3.78 ± 0.943	3.65 ± 0.994	-1.57	.117

An independent samples t-test was conducted to assess whether engagement in digital gaming is associated with teacher candidates' intentions to teach 21st-century skills with digital games. The analysis revealed that individuals who played digital games scored significantly higher intentions in several domains compared to their non-gaming peers. Specifically, game players exhibited greater creativity ($t(420) = -2.787$, $p = .006$), critical thinking skills ($t(420) = -3.156$, $p = .002$), technological proficiency ($t(420) = -2.370$, $p = .018$), and research skills ($t(420) = -2.065$, $p = .040$), with all differences reaching statistical significance. However, no significant differences were found between the two groups regarding communication skills or digital citizenship, as both comparisons yielded non-significant results ($t(420) = -1.573$, $p = .117$). These findings suggest that digital gaming may be positively associated with the development of certain cognitive and technical aspects of 21st-century skill sets among teacher candidates.

Discussion and Conclusion

The literature reveals a strong theoretical and empirical basis for using digital games in education, particularly in promoting 21st-century skills such as critical thinking, creativity, collaboration, communication, and digital literacy. Digital games offer engaging, interactive environments that can foster both cognitive and social competencies essential for success in modern life. However, the role of teacher candidates is pivotal in realizing this potential. While many future educators recognize the benefits of digital games, various challenges – including lack of training, limited experience, and institutional barriers – hinder their readiness to integrate games effectively into their teaching. Additionally, current research highlights several gaps, including the need for more detailed, skill-specific studies and a deeper understanding of the role of teacher education programs in preparing candidates for game-based learning. Addressing these gaps is essential for enhancing the effective use of digital games in fostering 21st-century skills and empowering future teachers to innovate in their classrooms.

A cross-tabulation of gender, academic department, and digital gaming status is presented in Table 1. The findings indicate that male participants generally exhibited higher digital gaming rates across all departments compared to female participants. In particular, male students from the Computer Education and Instructional Technologies (CEIT) and Mathematics Education departments reported the highest engagement rates. Conversely, female students from the Early Childhood Education and Turkish Education departments reported the lowest gaming rates. Overall, students from technology- and mathematics-related programs demonstrated greater engagement with digital games, while those from traditional teaching disciplines were less likely to engage in digital gaming. These patterns suggest that gender and academic department have a significant influence on students' digital game-playing behaviors. Başaran and Şimşek (2024) also discovered that males are predominantly classified as regular or frequent gamers, whereas females are more commonly identified as casual or non-gamers. On the other hand, Çobanoğlu et al. (2024) noted that female students are more likely to play digital games than male students. According to them, female students' greater interest in digital games may be due to their desire to create their own virtual environment. So, it can be said that this gender and gaming relation should be investigated further.

Participants' preferences for digital game genres varied considerably. As shown in Table 2, the most frequently played genres were Intelligence games (69.8%), puzzle games (56.2%), and educational games (49.2%). In contrast, Role-Playing (11.2%) and Platform games (11.8%) had the lowest participation rates among respondents. Genres emphasizing cognitive skills, such as problem-solving and educational development, were more popular than action-based or simulation games. These results suggest that participants favored games that supported intellectual engagement and skill development, reflecting possible influences from their academic backgrounds or professional interests. Similarly, Yıldırım et al. (2021) found that university students prefer cognitively challenging games. The study found that students commonly played online games that required strategic thinking and problem-solving, which aligns with the popularity of intelligence and puzzle games in their findings. Further supporting this conclusion, Vo et al. (2024) found that those with better cognitive capacities prefer games that require strategic and abstract thinking, such as puzzle games. These games are related to better problem-solving abilities, logical reasoning, and critical thinking.

The present analysis examined participants' reported motivations for gaming, identifying clear trends in the underlying purposes for gaming activities. The most frequently endorsed reason was to have fun, with 81.3% of valid respondents selecting this option. This finding highlights the primary role of intrinsic enjoyment in gaming behavior, consistent with prior research that emphasizes entertainment as a core motivator across various gaming populations (Ryan et al., 2006). Similarly, 77.6% of participants indicated that relieving boredom was a reason for gaming, suggesting that games are a convenient and accessible means of occupying free time and combating monotony. Stress relief also emerged as a significant motivator, with 65.0% of respondents reporting that they used gaming as a method of emotional regulation. Together, these findings highlight the psychological utility of gaming for managing affective states, offering players both pleasure and relaxation. Motivations related to competition and challenge were endorsed by 48.3% of participants, indicating a moderate emphasis on achievement-oriented gaming. This suggests that, while competitiveness is an important factor for a substantial portion of players, it is secondary to motivations rooted in personal gratification and emotional well-being.

Lastly, individuals who played digital games scored significantly higher intentions in several domains than their non-gaming peers. In other words, gamer teacher candidates believe they can teach 21st-century skills and use digital games to teach those skills more than their non-gamer peers. Specifically, game players exhibited greater creativity, critical thinking skills, technological proficiency, and research skills, with all differences reaching statistical significance. However, no significant differences between the two groups regarding communication skills or digital citizenship were found, as both comparisons yielded non-significant results. These findings suggest that digital gaming may be positively associated with the development of certain cognitive and technical aspects of 21st-century skill sets among teacher candidates. Teacher candidates often perceive games as tools that boost student motivation, engagement, collaboration, and critical thinking (Bourgonjon et al., 2010; Kenny & Gunter, 2011).

Recommendations for Practice

The findings of this study offer several implications for teacher education programs aiming to foster the effective integration of digital games into pedagogical practice. Given the participants' preference for cognitively demanding games, educators and curriculum designers should consider integrating game-based learning tools emphasizing problem-solving, strategic thinking, and critical reflection. These games align closely with the goals of 21st-century skills education and may be more readily accepted by teacher candidates due to their perceived intellectual value. Differentiated support strategies may be needed, as digital game engagement varied notably across academic departments, particularly between technology- and mathematics-oriented programs and more traditional fields, such as Early Childhood Education and Turkish Education. For departments with lower digital gaming exposure, targeted interventions—such as discipline-specific workshops or showcases of subject-relevant educational games—can help to bridge the engagement gap and build confidence in applying game-based learning in the classroom.

Furthermore, the widespread use of smartphones for gaming suggests a strong potential for mobile-compatible educational games in teacher training. Developers and instructors should prioritize accessible tools across common mobile platforms to reduce technical barriers and support flexible learning environments. The motivational factors driving game use among participants—particularly enjoyment, stress relief, and reduced boredom—underscore the importance of intrinsic motivators in educational design. Game-based learning experiences that incorporate fun, relaxation, and autonomy may be more effective in fostering sustained engagement than those relying solely on extrinsic rewards or formal instructional goals. Finally, given the influence of gender and academic background on gaming behaviors, teacher education programs should adopt inclusive approaches that account for differing levels of technological familiarity. Providing equal opportunities for exposure and skill-building in digital game integration will help ensure all teacher candidates are prepared to leverage these tools for diverse learning contexts.

Recommendations for Future Research

The present study highlights several avenues for future research. First, there is a need to investigate how teacher candidates' pedagogical beliefs and perceptions of the educational value of digital games influence their intentions to incorporate such tools in their future practice. This is particularly relevant for candidates in programs with lower levels of game engagement, where skepticism or unfamiliarity may be more pronounced. Future studies could explore how these beliefs interact with personal gaming habits, discipline-specific norms, and prior experiences with educational technology. Additionally, sociocultural factors—such as prevailing cultural attitudes toward play, institutional expectations, and national curriculum

guidelines—deserve greater attention. Understanding how contextual variables influence game-related perceptions can help inform more culturally responsive approaches to game-based teacher education.

Longitudinal research is also recommended to examine how teacher candidates' attitudes and intentions evolve throughout their education and into their early professional practice. Such studies could track whether initial motivational patterns persist or shift as candidates gain pedagogical experience and exposure to game-based learning tools. Moreover, given that the current study employed a self-developed survey instrument, future research should undertake systematic psychometric validation to ensure the reliability and construct validity of the instrument across different educational contexts. This step is crucial for strengthening the generalizability and interpretive power of findings in similar studies. Finally, while participants' social motivations for gaming were minimal, further inquiry is warranted to explore whether and how collaborative or multiplayer educational games can enhance social learning and peer engagement among teacher candidates. Exploring these dynamics could reveal new pathways for utilizing games to enhance individual motivation and cooperative learning skills.

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