https://doi.org/10.53964/jmer.2023005

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Journal of
Modern Educational Research

ISSN 2790-3192 (Online)

Open Access

Research Article

Exploring Game Behavior, Scaffolding, and Learning Mathematics in Digital Game-based Learning Apps on Children

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Received: November 12, 2022 **Revised:** December 11, 2022 **Accepted:** January 19, 2023 **Published:** April 14, 2023

Abstract

Background: Due to the increasing growth of the use of digital learning in schools, the rate of young students' use of educational digital games has also increased. Digital game-based learning (DGBL) includes various features. Each user may be attracted to certain features of each game due to their individual characteristics. However, it is not clear how individual differences and teachers' scaffolding can affect learners' learning responses to learning-based digital games.

Objective: The purpose of this study is to explore game behavior, scaffolding, and improving learning mathematics in DGBL apps for children.

Methods: This study has examined Khan Academy as a DGBL application in mathematics subject in the virtual school classroom. The interview method is a qualitative case study. A total of 21 young students at the primary level in Iran participated in this (ages 6-8). The presence of the teacher with the students during the learning of mathematics and its effect has been analyzed. From two types of scaffolding, the presence of the teacher in the classroom was considered one by one and the whole class. Both types of scaffolding had an effect on students' learning.

Results: The results of the data analysis indicated that users with high experience in cooperation and increasing social skills had better progress and higher socialization than users with low experience. This is in case the less experienced users have paid more attention to the learning concepts in the game.

Conclusion: Thus, the teachers' scaffolding enabled students to discover their interest in mathematics more independently and to be more motivated and active to solve problems. The findings of this research can be helpful for framework designers in the field of children's behavior in designing games based on learning.

Keywords: digital game-based learning, individual differences, mathematics, teachers' scaffolding, young children

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Citation: Hayati S, Behnamnia N. Exploring Game Behavior, Scaffolding, and Learning Mathematics in Digital Game-based Learning Apps on Children. *J Mod Educ Res*, 2023; 2: 5. DOI: 10.53964/jmer.2023005.

1 INTRODUCTION

These days, the tendency to use digital technology has increased. Following the outbreak of the COVID-19 pandemic the trend towards online education and educational games in schools is also increasing rapidly. For this reason, research on digital educational games has received more attention from many researchers. Several types of digital games have emerged in recent decades, such as gamification, serious games, and digital game-based learning (DGBL)[1-4]. These games have different purposes. For example, game elements such as scoreboards, achievements, badges, and levels are used in gamification to engage the mind and body of users[3]. Serious games are computer games that are the main purpose is not entertainment[4]. These games are usually used to improve the learning outcomes of certain disciplines among users[5]. DGBL also includes two elements of entertainment and education for educational purposes[6]. One of the benefits of DGBL games is the integration of digital games in a learning environment such as a school[7]. The most important reason for combining learning with game elements in DGBL games is for students to experience a fun learning process[8]. Among the categories of digital games, the tendency to use digital games based on education is broader recently. Hence, these games have recently been widely used to support various training courses[9]. A variety of digital games can be used to integrate into training-based digital games. Among these, online educational games are one of the most popular and attractive games that have recently been used among schools[10]. These online educational games provide a virtual learning environment for students[11]. Where a number of players interact simultaneously in a virtual environment. In the environment of virtual online educational games, players play different roles that lead to social cooperation and interaction with other players[12]. In addition, students try to solve the challenges in the game by cooperating and working together. Students' efforts to provide solutions to problems increase their ability to make decisions and problem-solving skills[5]. However, given that students each have their own individual and moral characteristics, they react differently to the challenges of the game[13]. Among the various individual differences, experience in previous games in the DGBL environment can have a profound effect on students' skills and how new DGBL games are played. Increasing competence in skills can also affect students' play behavior[14].

These days, one of this favorite media apps for kids is Khan Academy (KA). KA is an innovative online resource platform for personalized learning, available free of charge to anyone with internet access[15]. This platform is a hybrid learning for constructing constructivist knowledge, involving interaction and personal accompaniment with student and environmental content, teachers, and other learners. In the KA platform, this learning accompaniment is relevant to students' daily lives[15]. Millions of users around the world can access the content of this platform in various fields. The platform enables learners to engage in self-directed and lifelong learning. In recent years, the use of KA has increased in schools around the world. KA has been widely used in online schools to increase the efficiency and effectiveness of the learning process, especially during the coronavirus pandemic[15].

On the other hand, educators play an essential role in learning digital games based on education in young students[16,17]. Some researchers believe that teachers play a facilitating role in increasing students' learning in digital games[18]. Teachers work with students when using digital games to actively engage them in learning, control the learning process, support students based on their needs, and provide the resources needed to support learning at the right time[17,19,20]. On the other hand, some researchers believe that the role of the teacher alongside students in DGBL can have a negative impact on learners' perception of learning and their enjoyment while playing. Therefore, the proper understanding of the role of games and coaches along with each other in the level of learning and interaction is very important[19,20].

Based on KA, teachers give students structured learning tasks that include descriptions, pictures, and exercises. It is even possible for students to refer to the supplementary content available on the website if they need information beyond the required assignments. However, it is not clear how individual differences and teachers' scaffolding can affect learners' learning responses in KA. Hence, the purpose of this study is to explore game behavior, scaffolding, and improving Learning Mathematics in DGBL (KA) apps for children. Therefore, due to the importance of this issue, this study is to understand the individual effects of students, especially the game experience on their game behavior with the aim of its effect on the rate of math learning for children. As mentioned, individual differences, especially the level of play experience and how learners generally behave in the game in the digital environment affect children's learning process. In addition, in this study, the method of presenting teacher scaffolding in DGBL (KA) apps has been also examined. The presence of the teacher with the students during the learning of mathematics and its effect has been analyzed. A teacher's scaffolding attendance in the classroom was examined in two ways: individually guided students, and in a whole-class setting. Therefore, the researcher has tried to find the answer to these questions during this research:

- How do teachers' scaffolding strategies (individually guided students, and in a whole-class setting) affect students' success in learning math in DGBL (KA) apps?
- How do individual differences and generally behave, especially levels of game experience affect students' success in learning math?

1.1 Scaffolding

Scaffolding was first introduced by Wood et al.[21] as a coach or mentor who enables a child or novice user to solve a problem, perform a task in the game, or achieve game goals without the help of others. Other researchers also believe that scaffolding is actually temporary support for a teacher or knowledgeable person (such as parents) to help students with digital games[11]. This support can include, for example, modeling, questioning, challenging, and so on. Research shows that providing timely support from the teacher improves the learning process in students[22-24].

Tropper et al.[25] suggested that the scaffolding process consists of three steps: a) Probability, which includes accountability, adaptability and timely performance of students; b) Reduce support after improving user (student) performance; and c) Transfer responsibility for the learning process. These steps are closely related. So, in education-based digital games, teachers can gradually reduce support when students are in the process of improving their learning performance. Decreased teacher support shifts the responsibility from teachers to students. This change allows students to do the learning process independently[23,25].

Another researcher believes that scaffolding is an interactive process between teachers and students during educational games to improve students' learning[24]. To provide support and intervention in education-based digital games, teachers must first effectively identify the current level of students' achievement. Therefore, the relationship between students and the teacher is very helpful in determining this level in the first place[23-25].

Muhonen et al.[23] emphasize that interactions and conversations between teachers and students in the use of digital games can play a very important and decisive role in the learning and development of young students. Through dialogue between students and teachers, the scaffolding provides an opportunity for students to realize their understanding of issues and to analyze and develop their thinking[23,26].

1.2 DGBL Apps in Mathematics and Game Behavior

Researchers have provided different definitions of digital games for education[27-30]. Several authors have interpreted education-based digital games as a kind of interactive game to target users based on the set of rules and constraints agreed upon. These educational digital games guide users to the path by solving challenges towards the goal[30,31]. Some of the researchers believe that defining digital educational games is in terms of feedback from users' games, for example, giving awards, star, scores or even changing the playing space to help players achieve their goals with educational issues[32].

Another definition of DGBL states a policy template that allows players to enter variables or modify actions and then see the results of their actions[33]. While designing DGBL apps is primarily aimed at enhancing learning, they can also be very entertaining. Hence, In order to effectively communicate with audiences, digital educational games must be entertaining[33]. Wilson et al.[32] have strongly recommended the use of technology and DGBL in order to support the learning progress made by preschoolers. The subject of mathematics helps students develop many skills that are useful in their daily lives[34,35]. However, math is a very tedious subject for most young students in the classroom. For example, a researcher in 2013 showed that mathematics is classified as an unpleasant subject among children[36]. Because it is difficult for children to solve math problems and children find it useless and unnecessary[34,37]. Researchers have shown that people who had difficulty learning math as children have been harmed in their future lives and in their career expectations[34,37].

Therefore, it is very important to develop effective methods to increase students' motivation and interest[10,34]. Increasing the skills of young students in improving their understanding of conceptual knowledge and their ability to develop problem-solving also plays an important role in future children's careers[38]. In digital games based on education, practicing arithmetic and problem-solving skills should be considered as one of the main elements in designing these games[39]. On the other hand, due to the attractiveness of the environment of the digital games, the level of student participation in digital math games is facilitated and increased[38,40].

The great potential and positive impact of digital games to motivate children and young students to enhance their learning has been recognized by researchers for decades[41,42]. In addition, the interaction and attractive visual environment of these DGBL apps entertain young students and reduce their anxiety and frustration[34,41,43]. On the other hand, some researchers believe that these educational games based on education are not only fun but also give students the opportunity to make mistakes several times and increase participation, search, and curiosity[19,44].

Other researchers believe that digital game based-learning facilitates increased interest in learning[45,46]. These scientists confirm that DGBL apps increase confidence to solve problems and create a greater desire to continue playing and solving more challenges[44,46].

In summary, the above studies showed that digital games based on education have the potential to improve math learning. However, how students behave in a digital game-based math learning environment is still unclear. On the other hand, the impact of students' experience on playing and the amount of learning in the digital environment is also unclear. Therefore, there is a need to study game behavior and learners' experience in the digital gaming environment.

1.3 FRAMING

1.3.1 Game Overview

KA kids is a free mobile app, a fun activity for kids that meets all the criteria for K-2 math. Children can learn while enjoying the basics, basics, and comprehensive learning content of KA kids. The environment DGBL (KA) was created by combining the features of learning materials[47].

Exploring DGBL (KA) apps was a challenging process, with two data experts spending four months investigating DGBL (KA) apps and using various virtual environments in this app on young children (Figure 1).

1.3.2 Pedagogical Strategy

The learning strategy chosen in DGBL (KA) apps was the tasks based on math learning, as these tasks could stimulate children to better solve math problems. Teachers and parents can also be valuable resources for creating math records through DGBML teaching and their teaching approaches for children. Teachers support children by encouraging them to solve math problems, skills and thinking, and solve challenges.

1.3.3 Role of Teachers and Parental Engagement

The emergence of digital technologies in today's world has become an essential part of the lives of teachers and students[48]. Therefore, the way teachers interact with students has also been changed and challenged[49]. Therefore, to argue the need for teachers' knowledge to integrate and interact more effectively with the world of technology, several frameworks were introduced. One of the useful frameworks is technology pedagogical content knowledge (TPACK), which serves as a framework for designing and developing programs to equip teachers with knowledge related to digital games and modern technology (American Association of Colleges of Teacher Education, Committee on Innovation and Technology, 2008). TPACK is a theoretical framework intended for thinking about teachers' knowledge to integrate technology and education and includes seven main components[50]:

1. Technology knowledge (TK): Knowledge about various educational technologies.
2. Content knowledge (CK): Sufficient knowledge that teachers should know about the subject they are teaching.
3. Pedagogical knowledge (PK): necessary knowledge about teaching methods and processes such as class management, evaluation, student learning, etc.
4. Pedagogical CK: Educational CK is different for different fields of education. Because the integration of content and education leads to the development of a better educational method of learning.
5. Technological content knowledge (TCK): Necessary knowledge about the use and new methods of technology for specific content.
6. Technology PK: Necessary knowledge in using different technologies in teaching.
7. TPACK: Knowledge needed by teachers to integrate technology in their teaching in any content area. Teachers who possess the skill of the seventh component act with intuitive understanding and better knowledge of the complex interaction of three knowledge components (TK, PK, and CK).

Therefore, in this research, the TPAK framework has been used in the selection of teachers (Figure 2).

2 MATERIALS AND METHODS

In this study, the authors used a 'case study' qualitative method involving two main steps used to collect the data: structured questionnaires and semi-structured interviews. Children were observed at home by recording with each parent's mobile phone camera. It was also observed by recording using webcam recording software for children's group chats in the presence of an online teacher. Teachers and parents should fill in the forms required by the researcher after observing the children's activities. Interviews were conducted with the full consent of teachers and parents. The interview took place while teachers were in an online e-learning class. The interviews were transcribed by the researcher using Rev.com software alone. The text was sent to parents and teachers for final approval and verified. The data obtained from the interviews were then encrypted using Nvivo software.

2.1 Participants

The participants consisted of 21 primary school children (ages 6 to 8) from an international private school in Iran. The student's math skills were monitored and all had low math skills based on their grades from the previous semester. All students had different experiences with digital games. According to a small sample (n=21), participants were divided into two

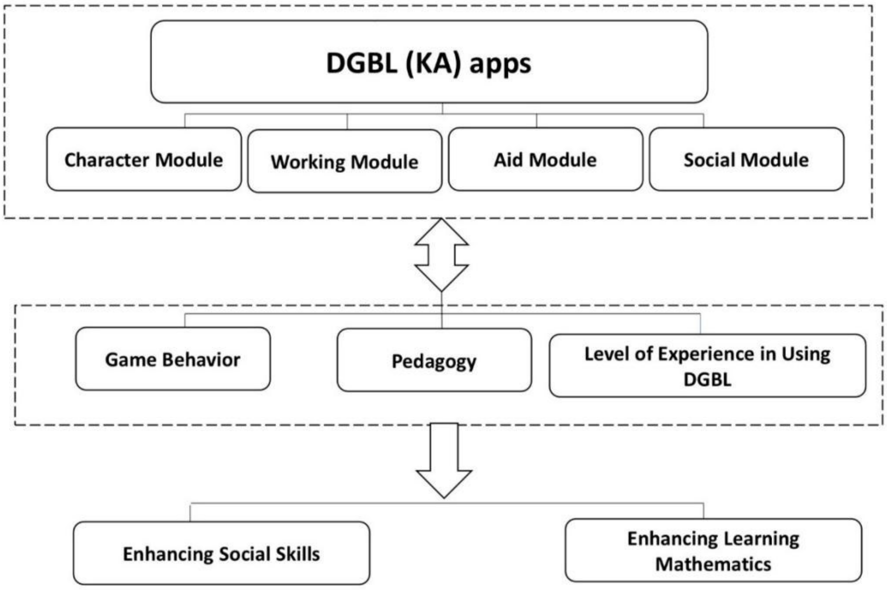

Figure 1. The framing of the DGBL (KA) apps.

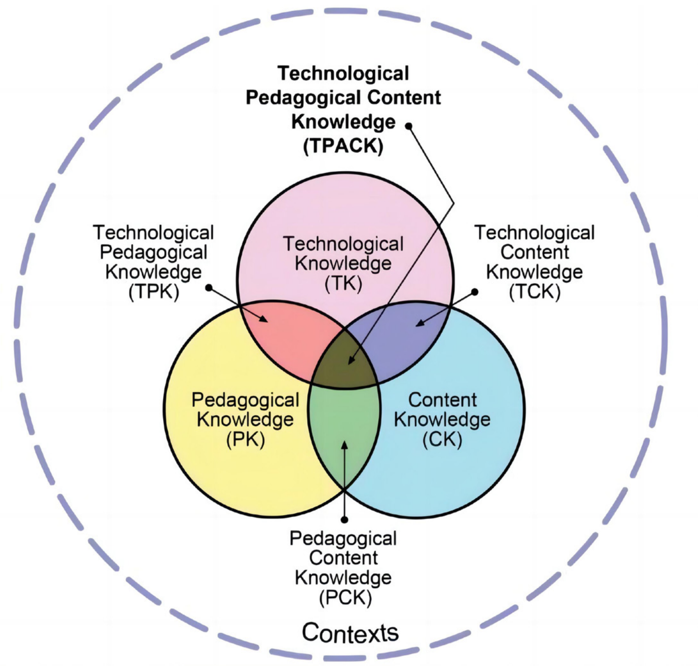

Figure 2. The components of the TPACK framework[50].

groups based on the number of days they played online games. In particular, it was conducted for students with a lot of game experience and students with little game experience. There were 12 children with a lot of game experience, and 9 children with little game experience. Comparing the high and low gaming experiences, we found that there was a significant difference between the two groups, indicating that the two groups had very different gaming experiences.

2.2 Compliance with Ethical Standards

In this study, parental consent was based on BERA's ethical guidelines, and much attention was paid to body language and other aspects indicative of child discomfort. For example, if the teachers noticed that the children were upset, tired, and annoyed, they would stop the online class[51]. Student participation in this study was completely voluntary and could be withdrawn at any time. Anonymity and confidentiality are fully guaranteed in this survey. The participant's name is also anonymous and all data is accessed and stored with a password, accessible only by authors.

2.3 Data-collection Procedure and Analysis

Qualitative data in this study were collected through classroom observations and student interviews. This research was done for about 20min every day. Three classes participated in the experiment, in which the first author collected observational data over 15 days. Data collected from observations included the effect of play on students' math learning rate. On the other hand, this study was conducted to examine the teachers 'scaffolding to increase students' learning in digital games based on online learning. Examining this scaffold also investigated the impact of digital games on levels of interaction and conversation, as well as social skills, timely training, and adaptive support and encouragement. In addition, students in the math class were interviewed by the math teacher. The authors investigated the degree of interaction between students and teachers in mathematics subjects. Each interview lasted approximately 5min.

Teachers recorded their observations and opinions about student learning levels in the digital game learning environment. Interview questions were provided by the first author. Responses and interviews were collected and recorded from 21 students.

After collecting the interview data, the authors began to transcribe the events. Then, based on the information obtained, the authors started the coding process[52]. The data encoding and transformation process was done with Nvivo software. In analyzing the data, the researchers used Hatch's inductive analysis[53]. Hatch[53] introduced an inductive analytical model. In this model, key data are collected directly from qualitative researchers through observational field notes, interview transcripts, and data from research sites and social phenomenon artifacts. This allows researchers to understand the social dimension and essentially quantify the information in the data to drive trends and understanding. Data collection should follow the data analysis phase to gain a deeper understanding of participant behavior. Most of these approaches involve text analysis for both verbal and written recordings of behavior. First authors had 200 codes found, then the number was reduced to 15 codes.

2.4 Data Analysis

The data set was analyzed using qualitative content analysis. Interviews were transcribed and analyzed by using the inductive analysis model in Nvivo. Also, the observations were analyzed using typological analysis. Throughout the process of analyzing the data from these sources, patterns began to emerge and were sectioned into codes (Figure 3).

In the second phase of the analysis with an overview of the data, interviews, and observations were analyzed to identify common themes and trends. The data analysis methods used focus on the results of interviews and observations, as well as the collection of documents as to the improvement of learning math among children[54].

Selection coding was used in the last process. In this phase, main categories were systematically organized and created from interview responses, relevant categories, confirmation of their relationships, and presentation of descriptions of undeveloped groups. In this research, all aspects of programming were studied to define and generalize code. The purpose of this coding method was to enable researchers to gain a deeper understanding of the experience and interaction of the phenomenon of interest (see Supplementary Table 1).

The first group of this coding first produced 12 subgroups that were classified into two main categories. A category was presented including:

1. data collected from interviews indicating the rate of mathematics learning among young students in DGBL digital games (comparing children with a high play experience and children with a low play experience),
2. understanding and describing the teacher scaffolding in the classroom and the impact of the teacher`s presence alongside online educational games based on education.

3 RESULTS

Qualitative data from interviews show differences between children with high levels of gaming experience and those with low gaming experience. These differences were very evident in terms of game support to improve children's problem-solving skills on math problems. Children who were more experienced with digital games formed more social connections with their peers. On the other hand, children with little game experience immersed themselves in the content of the game and tried to understand the game environment (see Table 1).

As such, children with more gaming experience, especially in DGBL (KA), had a better understanding of game performance and therefore refused more material to speed up game progress. On the other hand, children with less experience playing in the DGBL (KA) environment were more attentive and focused on all details. Furthermore, children with more experience playing digital games were less likely to ask their teachers for help in solving problems. However, children with less game experience continued to ask their teachers to help them solve math problems (see Table 2).

3.1 Teacher Scaffolding Strategies

According to the scaffolding strategies used in previous studies, in this study, the analysis of observations and interviews based on scaffolding strategies in the general classification of the class and one by one has been done[19,23,26].

3.1.1 Scaffolding of Whole-class

Scaffolding in the online classroom included introducing game information, showing game steps, showing game

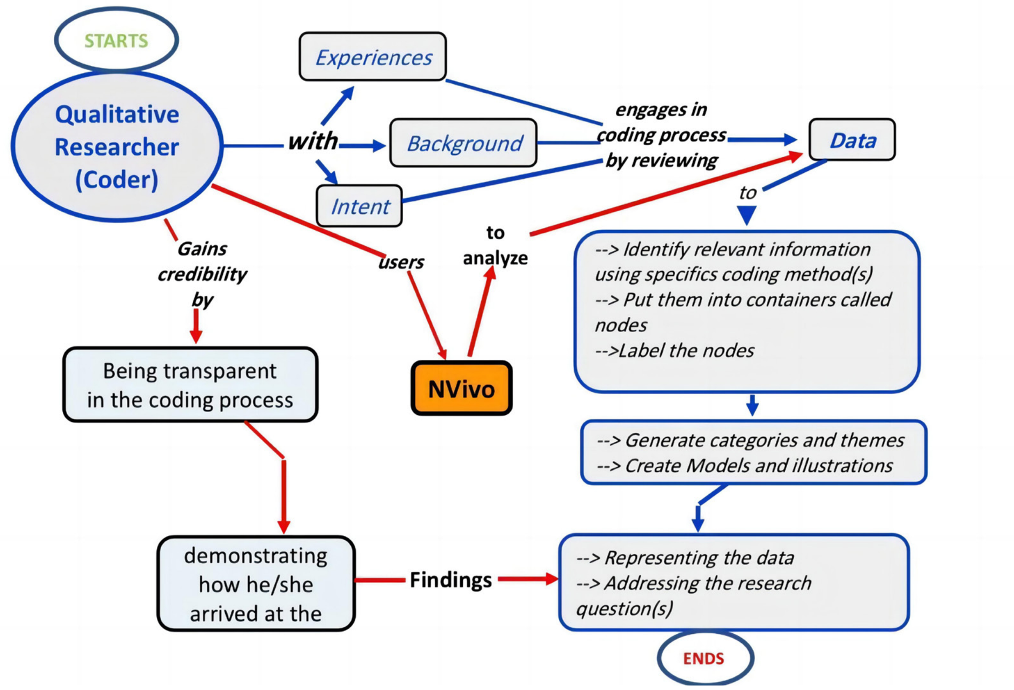

Figure 3. Qualitative analysis process in Nvivo.

Table 1. Effects of Different Levels of Gaming Experience on Overall Game Behavior and Learning Mathematics

Category	Gaming Experience	Per Percentage (%)
Enhancing Social Skills	High Level Game of Experience	86.19
	Low Level of Game Experience	31.42
Enhancing Learning Mathematics	High Level Game of Experience	66.66
	Low Level of Game Experience	80.95

Table 2. Final Classification of Data Categories

Category 1		Category 2
Whole class scaffolding:	One-to-one scaffolding:	• Reflections on scaffolding
• Problem demonstration	• Asking to think first	• Development of arithmetic skills
• Solutions shared by students	• Guiding to analyze problems	• Activation interest in mathematics
• Solving steps present by teachers	• Offering hints	• Encouragement to explore
• Summary of method and strategies		

goals, and general familiarity of students through the teacher with the DGBL (KA) applications. Observations and interviews show that students listen to their teachers and interact with the teacher and play through questions and answers. The results of the observations show that students prefer to use digital games to solve their problems and have a more active and lively presence in the online classroom. On the other hand, strategies used in games such as scaffolding (which determine the level of challenge, finish training, and award stars or coins). Digital games, along with their accompanying teachers, play an important role in the overall management framework of the classroom.

Teachers have a positive combined effect on all stages of students' learning. Thus, the teachers' scaffolding enabled students to discover their interest in mathematics more independently and to be more motivated and active to solve problems. In this way, students will gain a deeper understanding of problem-solving. The results of this experiment show that the teacher motivated children and interacts with the students while facing the mathematical challenges in the digital game, causing the students to gain a deep understanding and find a clear way to solve the problem (see Table 3).

3.1.2 Scaffolding of One-to-one

This scaffolding was defined when it happened that the student was not able to solve the problem

https://doi.org/10.53964/jmer.2023005

Table 3. Learning Outcomes Whole-class

Learning Outcomes Whole-class	Number of Students (From First Day to End of Interview)		Percentage (%)
Affective and motivational	8	16	76.19
Knowledge acquisition/content understanding	7	15	71.42
Perceptual and cognitive	5	14	66.66
Improving problem-solving skill	9	17	80.95

independently and individually. Therefore, the teacher should be individually and adaptively supported by the student during the digital game to help him/her solve the problem. For example, teachers can teach tips when needed and introduce students to problem-solving methods and steps. It is important that the teacher encourages students to think individually and independently. For example, one student stated;

"The teacher asked me to think about number relations, and then gave the example that I could look at the number of fingers on my hand. This made it much easier for me to solve the problem."

Conversations between the teacher and students in the DGBL class, individually or in general, made the current level of students' understanding recognizable through the teacher. The teacher has followed the adaptive approach in this support. Dialogue interactions have played an important role in students' deeper growth and development of problem-solving and knowledge-transfer skills[23]. The results of interviews and observations of this study indicate that the integration of one-to-one scaffolding and general scaffolding in the classroom has had a significant effect on students' learning and progress in mathematics in preschool education (see Table 4).

3.2 Impact of Teacher Scaffolding

The results show that teachers' timely support for students and teachers' use of adaptive instruction has a positive impact on student learning. On the other hand, teacher support for students gives children the opportunity to control the problem-solving learning process. For example, many students report that the teacher's timely support and guidance during the game enabled them to fully focus on problem-solving and successfully solve problems. Students confirmed that the presence of a teacher alongside digital education-based games increases their desire to learn mathematics. As a result, this effort made her mind more active in proposing solutions to challenges. The positive presence and encouragement of teachers enabled students to act more independently and creatively when faced with challenges (see Table 5).

Therefore, based on that the scaffolding process, Tropper et al.[25] suggested that consists of three steps; a) Probability, which includes accountability, adaptability and timely performance of students. b) Reduce support after improving user (student) performance, and c) Transfer responsibility for the learning process. Results show that these three steps of scaffolding in education-based digital games have a favorable combined influence on absolutely all phases of students' learning. In the early years, teachers offered more assistance to students. As a result, as student knowledge and problem-solving skills increased in the game, the level of teacher support gradually decreased. Students felt more accountable for handling obstacles as a result. As a result, the teachers' scaffolding allowed pupils to autonomously find their passion in mathematics and to be more engaged and involved in problem-solving (see Table 6).

4 DISCUSSION

Regarding the social relations and the applicability of these games to increase children's social skills in socializing, the results indicate that children with higher experience in games than children with less experience in games chatted more with their friends. Findings show that these children with more experience in digital games were more familiar with the game environment and therefore focused their attention on socializing with their friends. These results are consistent with the findings of a researcher in 2010[55]. This researcher in his research demonstrated that players with more game experience speak and are more active in discussion than those with less game experience. On the other hand, children who had previous play experience asked teachers for less help, while children with less play experience asked teachers for more help in solving math problems. This shows that previous play experience is an important factor in children's learning rate and solving math problems.

In addition, in this study, the method of presenting teacher scaffolding in DGBL was also examined. The presence of the teacher with the students during the learning of mathematics and its effect were analyzed. As mentioned in the previous sections, in this study, from two types of scaffolding, the presence of the teacher in the classroom was considered one by one and the whole class. Both types of scaffolding had an effect on students'

Table 4. Learning Outcomes One-to-one

Learning Outcomes One-to-one	Number of Students (From First Day to End of Interview)		Percentage (%)
Affective and motivational	8	20	95.23
Knowledge acquisition/Content understanding	7	20	95.23
Perceptual and cognitive	5	17	80.95
Improving problem-solving skill	9	19	90.47

Table 5. Learning Outcomes

Learning Outcomes	Total Percentage (%)
Affective and motivational	85.7
Knowledge acquisition/Content understanding	95.2
Perceptual and cognitive	71.4
Improving problem-solving skill	90.47

Table 6. Learning Outcomes

Learning Outcomes	Probability (From First Day to End of Interview) Total Percentage (%)		Reduce Support (From First Day to End of Interview) Total Percentage (%)		Transfer (From First Day to End of Interview) Total Percentage (%)	
Affective and motivational	34.2	83.7	25.2	85.7	35.2	85.7
Knowledge acquisition/ Content understanding	22.4	94.8	24.7	95.2	25.1	94.2
Perceptual and cognitive	36.2	81.5	34.5	91.4	31.2	91.3
Improving problem-solving skill	28.9	93.11	27.9	92.47	22.4	89.43

learning. The results of this study are important because by highlighting the level of participation and support of teachers along with students, it has a direct impact on students' learning. In other words, it will help bridge the gap in prior knowledge by highlighting and maintaining the appropriate scaffolding for teachers alongside education-based digital games.

While few researchers paid less attention to whole-class scaffolding[19,23,24,26], in this study, the results of analysis of interviews and whole-class scaffolding observations indicated that in the first few days, students' familiarity with digital games based on highly educational gives direction[26]. The support of the teacher alongside the students made it easier for the students to find solutions to the challenges[23,56]. One by one, the scaffolding helped students find solutions to problems later in the classroom. One by one, the teachers helped the weaker students to act more independently during the game and increase their motivation and interest to continue playing[42,57].

Observations and interviews show that students listen to their teachers and interact with the teacher and play through questions and answers. The results of the observations show that students prefer to use digital games to solve their problems and have a more active and lively presence in the online classroom. On the other hand, the strategies used in the game, such as scaffolding, for example (determining the level of challenge, stopping training, giving stars or coins). In digital games, along with accompanying teachers, it plays an important role in the general management scaffolding of the classroom[42,57].

Findings indicate that the three stages of scaffolding in education-based digital games, namely probability, disappearance and transfer of responsibility, have a positive combined effect on absolutely all stages of students' learning. Teachers had more support for students in the early days. Therefore, with the increase of students' knowledge and thinking in problem solving in the game, the level of teachers' support was gradually reduced. In this way, students felt more responsible for responding to challenges. Thus, the teachers' scaffolding enabled students to discover their interest in mathematics more independently and to be more motivated and active to solve problems[23-25].

This development will allow students to become acquainted with modern technology such as smart pages and applications, in addition to learning the basics of their subjects, including mathematics. With the advent of technology in the field of education, teachers can gradually show their place in reducing the level of interest and influence of students in learning lessons[42,57]. The results of this study show the growth of the level of learning of primary students and on the other hand, the level of understanding of the content and creating a solution by students by combining teacher scaffolding along with digital games has been a growing trend[16,39-41].

4.1 Limitations and Future Research

The number of studies on traditional math class scaffolding was small. Therefore, comparing the data obtained from the scaffolding of this study compared to the scaffolds of traditional classes was challenging. Therefore, it is suggested that in-depth interviews and questions about this comparison be obtained in future research.

5 CONCLUSION

This study deals with how individual differences, especially the level of experience of children's digital games at the primary level (6-8 years old). Each user may be attracted to certain features of each game due to their individual characteristics. The level of gaming experience associated with gaming skills can have significant implications for individual differences. Another goal of this study was to study children's behavior in learning mathematics and its effect on social interaction. In addition, in this study, the method of presenting teacher scaffolding in DGBL has been also examined. The presence of the teacher with the students during the learning of mathematics and its effect has been analyzed. From two types of scaffolding, the presence of the teacher in the classroom was considered one by one and the whole class. Both types of scaffolding had an effect on students' learning.

Therefore, this study has created and examined DGBL (KA) on mathematics in the virtual school classroom. The purpose of this study was to investigate how the experimental ability to play DGBL (KA) affects learner responses in mathematics learning, and how a teacher's scaffolding strategy affects students' success in mathematics learning. A total of 21 students at the primary level participated in this study. The interview method was a qualitative case study. The study also looked at how much help children receive from teacher-based digital games. Children with more experience in digital games were more likely to socialize and chat with their friends. While kids with less experience in digital games were more focused on game content. The results of data analysis indicated that users with high experience in cooperation and increasing social skills had better progress and higher socialization than users with low experience. This is in case the less experienced users have paid more attention to the learning concepts in the game.

Acknowledgements
Not applicable.

Conflicts of Interest
The authors declared no conflict of interest.

Author Contribution
Hayati S and Behnamnia N studied, wrote, reviewed and corrected this article.

Abbreviation List
DGBL, Digital game-based learning
KA, Khan Academy
TK, Technology knowledge
CK, Content knowledge
PK, Pedagogical knowledge
TCK, Technological content knowledge
TPACK, Technology pedagogical content knowledge

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