An Evaluation of the Educational Games Implementation Process from the Teacher Candidates, Students and Parents' Perspective

[1] sibelernas@hotmail.com, orcid.org/0000-0002-5970-2811, Trabzon University, Türkiye

[2] havvayaman@trabzon.edu.tr, orcid.org/0000-0003-2952-2075, Trabzon University, Türkiye

Sibel ER NAS [1], Havva YAMAN [2]

ABSTRACT

The aim of the study is to evaluate the educational games implementation process from the science teacher candidates, students and parents perspective. The special case method, which allows evaluating an event in depth, was preferred. The implementation process was completed in 14 weeks. The study group consists of 36 science teacher candidates, 44 students and 43 parents of students. Interview and open-ended questionnaire were used as data collection tools. The data obtained from the interviews and open-ended questionnaire were analyzed by content analysis. Within the scope of content analysis, the data were coded and categorized and themes were found. The fact that students mostly emphasized the "learning by having fun" code regarding the implementation process of educational games also shows parallelism with the theoretical background of the adoption of games in the education field. Similar to the evaluations of the students, parents and science teacher candidates also emphasized that educational games are fun and instructive. Students think that the educational games make it possible to reinforce the knowledge they have learned. Unlike the students, the parents and teacher candidates evaluated the subject as "repeating the subject by having fun". It can be recommended to apply this study as a group in the classroom and to evaluate educational games in this way.

Keywords: *Educational games, science teacher candidates, student, parent, science education*

INTRODUCTION

Games that designed to be immersive and fun activities (Kinzie & Joseph, 2008), are an integral part of children's cognitive development stages. Games evolve along with these cognitive development stages (Piaget, 1962). More specifically, according to Piaget, games become more abstract, symbolic, and social as children mature at different developmental stages. In addition, graceful failures in games provide a safe environment that encourages trying new things, taking risks and exploring (Hoffman & Nadelson, 2010). Since games are adaptable to each student to engage individually (Plass, Homer & Kinzer, 2015), it has created a new trend towards the use of games in the field of education in order to increase student participation, performance, motivation and interest. Educational games used in the educational environment can be related or synonymous with different terms such as game-based learning, gamification, instructional games (De Freitas, 2006).

Game-based learning (hereafter the term 'educational games' is used), is learning through play rather than learning to play. (Wu et al., 2012). Educational games, which include game content and playing games to enhance knowledge and skill acquisition, represent a kind of learning environment (Qian & Clark, 2016). The theoretical background of the adoption of educational games for learning is that educational games offer an entertaining and active learning environment that includes both game mechanisms and learning (Lameras et al., 2017). Although there are various definitions in the literature, educational games involve a number of observations, challenges and problems, all of which lead to improvement in the student's cognition, learning performance and motivation (Connolly et al., 2012). Generally, during the educational game, students need to solve problems and complete challenges related to the course content. The purpose of educational games is to make the learning process more attractive for learners and enable them to gain different learning experiences (Güler & Güler, 2015).

In general, educational games are divided into digital educational games and traditional educational games (Chen et al., 2021). Digital games refer to games played using computers, mobile devices and electronic devices (Wang & Zheng, 2021). Traditional educational games refer to existing models of physical games such as dice, cards, board games or innovations from teachers themselves (Hamden Hamid, Zulkiply & Mohamad 2022). Unlike digital games, non-digital games do not need electronic devices and can be applied in different scenarios. For this reason, traditional educational games are widely used in science education (Demircioğlu & Akdemir, 2019; Hamden Hamid et al., 2022; Li et al., 2016; Şentürk, 2020; Yıldız et al., 2017).

Well-designed educational games have significant potential to enhance teaching and learning. Most students deemed learning science as difficult and unrelated to their daily lives. This situation is especially seen when students are faced with abstract and multidimensional scientific phenomena and they do not have sufficient foreknowledge (Corredor et al., 2014; Hodson, 2014). Researchers and educators, who noticed this situation of students, suggested that one of the most important elements in science teaching is to instill fun and novelty in classroom activities (Jack & Lin, 2017). In this respect, educational games in science education appear as a promising method to support students' acquisition of scientific knowledge.

The positive effects of the use of educational games in science education have been reported in studies (Lester et al., 2013; Li et al., 2016; Lin et al., 2013; Sung & Hwang, 2013; Yien et al., 2011; Wang & Zheng, 2021). For example, Lester et al., (2013) showed that the game-based environment significantly improved students' knowledge of both science subject and problem-solving skills (Lester et al., 2013). In another study, the majority of students had largely favorable attitudes regarding the application of the game-based learning strategy in nutrition instruction (Yien et al., 2011). Educational games have a positive effect on improving students' problem solving skills (Lester et al., 2013; Li et al., 2016), motivation to learn science (Yıldız et al., 2017), and increasing their science achievement and self-efficacy (Sung & Hwang, 2013; Wang & Zheng, 2021). The integration of educational games into science education is increasingly supported. This situation has led to various literature reviews and meta-analysis studies on the use of different types of educational games in science education in recent years (Arztman et al., 2022; Cheng et al., 2015; Cop & Kablan, 2018; Riopel et al., 2019; Tsai & Tsai, 2020; Wang et al., 2022). For instance, Arztman et al. (2022) published a review of effects of games in STEM education and found primary school students get better learning results and find game treatments more motivating than secondary school students, whereas gender had no moderating influence. .Furthermore, Tsai and Tsai (2020) made a meta-analysis of research on digital game-based science learning and found learning and gaming methods both play key roles in enhancing students' scientific knowledge gains. In this regard, the majority of research in the literature focus on the development of educational games and their effects on students. In fact, Cop and Kablan (2018) combined the descriptive and experimental research on educational games in Turkey and the findings showed that the most of the research were conducted within the parameters of articles and master's theses, were mostly carried out using experimental methods, and the sample employed in the studies consisted mainly of up of students. Thus, educational game studies in science education are mostly carried out with students, and there are limited studies with science teachers or science teacher candidates who are practitioners of educational games in the classroom. Although it is a pleasing that educational games are being studied more in science education, the application process of educational games should be examined by science teacher candidates in order to be able to implement educational games effectively in their classrooms in the future. In addition, parents may tend to have strict perceptions (such as time consuming) towards playing games (Nikken & Jansz,

2006; Xie et al., 2021). Therefore, the evaluation of the educational games implementation process from the parents perspective points to an area that needs to be studied. Evaluation of the implementation process of educational games from the science teacher candidates, students and parents perspective is important for the adoption and dissemination of educational games in science education. Teachers are surely required to focus on the use of educational games, which have such significant impacts on students, in educational settings and to establish appropriate surroundings for this. If an educational game designed to be used in the teaching process is mentioned, it must have a purpose, go through a careful planning process, be appropriate for the students' level, as well as be original, interesting, and understandable. Teachers must go through an educational process in order to deliver these aspects in an educational game that they may use in the classroom. However, when we look at the undergraduate time, when teacher candidates completed their study and became aware of the usage of the relevant technique, we discover that such a course material is not included in various department programs in education faculties. According to this viewpoint, the use of the educational game method by science teacher candidates and, at this point, revealing their thoughts on the educational game in detail will have an idea about the usage of this approach in the teaching process.

Although there are studies in the field of educational games, it is thought that conducting a study in which games are evaluated from the perspective of students and teacher candidates will guide the regulations, games to be developed and researchers in the future. In addition, the evaluation of educational games from the perspective of parents will also contribute in this area. There are studies on the effect of games on students in the subject of educational games. In addition to the effect of educational games, the evaluation of students, teacher candidates, or parents will influence the games that will be developed in this field and the points that will be considered. It is believed that doing a study in which educational games are evaluated from the perspective of students and teacher candidates will influence the arrangements that will be made in this field, the games that will be developed, and the researchers. Furthermore, the evaluation of educational games from the perspective of parents would help in this field. Since this study was conducted during the pandemic, it was seen as a chance for the parents to view the games firsthand and a parent viewpoint was incorporated. All in all, in this study, it is aimed to evaluate the educational games implementation process from the science teacher candidates, students and parents' perspective.

RESEARCH METHOD

Research Model

The special case method, which allows evaluating an event in depth, was used in the study. The most important advantage of this method is that it gives the opportunity to focus on a particular case of a problem. The situation to be evaluated can sometimes be a school, an individual or a group (Denscombe, 1998; Wellington, 2000; Çepni, 2007). In this process, it is possible to study the researched problem in depth by using different data collection techniques together (Cohen & Manion, 1994; Çepni, 2007).

This study was carried out within the scope of the "Community Service Practices" course in the second year of the Science Teaching Program. The lecturer (Assoc. Prof. Dr.) who conducts the course has completed his doctorate in science education and has 16 years of experience. The study was carried out in the spring semester of 2020-2021. Community Service Practices course was conducted with distance education due to the pandemic. 36 science teacher candidates took the course. The implementation process of the study was completed in 14 weeks. First of all, the lecturer informed the science teacher candidates about what educational games are. In addition, sample applications on how educational games should be prepared were presented to them. Teacher candidates were asked to form groups of 2 or 3 people each. The science teacher candidates formed 8 groups of 3 and 6 groups of 2 each. After the groups were formed, the teacher candidates were asked to identify an acquisition/subject or unit at the secondary school level in the science program and to design an educational game within the scope of the acquisition/subject or unit they determined. The name of the educational, the number of teacher candidates and the aims/related outcome(s) of the educational games are presented in Table 1.

Table 1. *Names, Aims and Related Outcomes of Educational Games*

Names of the educational games	Group	Aim of the game and related outcome(s)
Mysterious Planets	3 people (3 females)	The aim is to make students comprehend the solar system subject in the 6th grade effectively. Related achievement: "F.6.1.1.1. Compares the planets in the solar system with each other."
Wheel of Maymit	3 people (3 females)	The aim is to make students comprehend the differences between meiosis and mitosis. Related achievement: "F.7.2.3.3. Compares the differences between meiosis and mitosis."
Bingo with the Elements	3 people (3 females)	The aim is to make learning the symbols of the elements easier and more fun. Related achievement: "F.7.4.2.2. Expresses the names, symbols and some usage areas of the first 18 elements and common elements (gold, silver, copper, zinc, lead, mercury, platinum, iron and iodine) in the periodic system."
What's My Secret?	2 people (2 females)	The aim is to teach the concepts about systems and which organs are involved in which system. Related achievements: "F.6.2. All the achievements in the "Systems in Our Body" unit are included in the game."
Knowledge Tower	2 people (2 male)	The aim is to learn the similarities and differences of living things, microscopic creatures, fungi, plants, animals, microscope, hygiene and safety precautions in an entertaining way. Related achievements: "F.5.2.1. All achievements in the subject of "Let's get to know living things" are included in the process."
Know the Question Take the Deed	3 people (3 females)	The aim is to evaluate the achievements under the subject of 5th grade 1st unit Sun, Earth and Moon. Related achievements: "F.5. 1. All achievements in the unit "Sun, Earth and Moon" are included in the process."
Know Find	3 people (3 females)	The aim is to classify the similarities and differences of living things by having fun. Related achievement: "F.5.2.1.1. Classifies living things according to their similarities and differences by giving examples."
Wheel of System Game	2 people (2 females)	The aim is to ensure that the achievements of the systems unit are learned by having fun. Related achievements: "F.6.2. All the achievements in the "Systems in Our Body" unit are included in the process."
See the Picture and Make a Description	2 people (2 females)	The aim is to provide understanding of acids and bases that are constantly encountered in daily life. Related achievement: "F.8.4.4.2. Gives examples of acids and bases from daily life."
One More Letter	2 people (2 females)	The aim is to teach the subject of acids and bases in a fun and permanent way. Related achievements: "F.8.4.4. All achievements in the "Acids and Bases" are included in the process."
Let's Dart with Science	2 people (2 females)	The aim is to understand by entertaining the achievements in the unit of systems in our body and health. Related achievements: "F.6.6. All the achievements in the "Systems and Health in Our Body" unit are included in the process."
The Attraction of Our Organs	3 people (3 females)	The aim is to understand the digestive system organs, their duties and their place in our body. Related achievements: "F.6.2.2. All achievements in the "Digestive System" are included in the process."
Let's Build Our House	3 people (3 male)	The aim is to teach the concepts in "World of Living Beings" unit. Related achievements: "F.5.2. All achievements in the "World of Living Beings" unit are included in the process."

Find Your Partner	3 people (3 females)	The aim is to enable them to learn the formulas, names and some usage areas of common compounds by matching them with the cards. Related achievement: "F.7.4.2.3. Express the formulas, names and some uses of common compounds."

Study Group

The study group consists of 36 science teacher candidates, 44 students and 43 parents of students. In the distance education process, the parents had the opportunity to observe the process, as the games were applied in the homes or close surroundings of the students. For this reason, it is aimed to include parents in the process and to evaluate the process in three dimensions (teacher candidates-students-parents). The teacher candidates selected the interviewed sample group (students and parents) through easily accessible case sampling that is one of the purposive sampling methods (Ekiz, 2015) because the study was carried out during the pandemic period. Partial and full-time closures during the implementation process were effective in the execution of the process in this way.

For each educational game, the number of interviewed students, parents of students and teacher candidates to whom the open-ended questionnaire was applied is presented in the Table 2.

In order to prevent data loss during the research process, it was requested to record the interviews using a tape recorder. In this way, it is aimed to minimize data loss by ensuring that the data is listened and monitored repeatedly. The interviews were conducted individually.

Table 2. *Number of Interviewed and Surveyed Participants*

Names of the educational games	Number of interviewed		Number of surveyed
	students	parents of students	science teacher candidates
Mysterious Planets	3	3	3
Wheel of Maymit	3	3	3
Bingo with the Elements	3	3	3
What's My Secret?	4	4	2
Knowledge Tower	2	2	2
Know the Question Take the Deed	5	4	3
KnowFind	5	5	3
Wheel of System Game	2	2	2
See the Picture and Make a Description	4	4	2
One More Letter	2	2	2
Let's Dart with Science	2	2	2
The Attraction of Our Organs	3	3	3
Let's Build Our House	3	3	3
Find Your Partner	3	3	3

Implementation Process of Educational Games

Science teacher candidates introduced the games they prepared in the online environment. The games were examined by the lecturer and their suitability for the achievement(s) was evaluated. 14 educational games were prepared by teacher candidates. In line with the suggestions of the lecturers, the teacher candidates gave the final form of their educational games. After the final form of the educational games, they started the implementation process. Photos from the implementation process of educational games are presented in the Table 3.

Table 3. *Reflections from the Implementation Process of Educational Games*
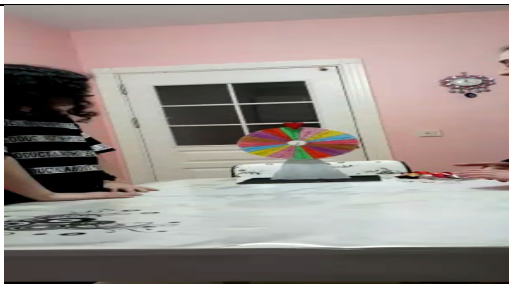
Mysterious Planets	
Players choose one of the cards in the box. Say the name of the planet in which the feature belongs.	Players check the correctness of their answers. Once the correct answer is learned, it is hung on the rope under the appropriate planet.

Wheel of Maymit	
Players spins the wheel. They tell whether the difference in the wheel belongs to meiosis or mitosis and explains why.	Points are awarded for each correct answer. The player with the highest score wins the game.

Bingo with the Elements	
Stone is selected. Whoever has the symbol on the stone, that person takes the stone.	The person who finishes first says bingo.
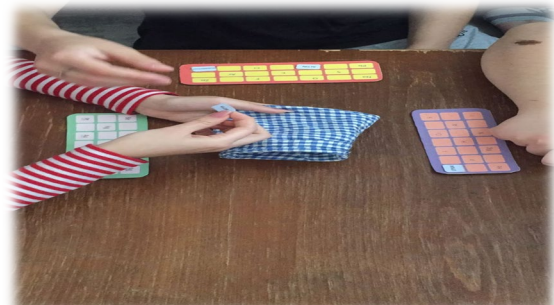
| What's My Secret?	
Players take turns pulling a card from the deck and placing it on their headband, regardless of what happens. The player asks a question to the partner in front of him to complete the picture in his head.	For each card answered correctly, players take a coin from the box and choose a new card from the box. The

person who gets 3 coins wins the game.

Knowledge Tower

The player pulls a block and tries to answer the question on "Let's get to know living things".
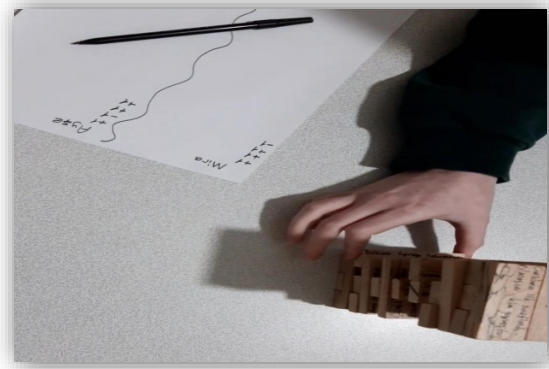
When the drawn block is destroyed, the player with the most answers wins the game.

Know the Question Take the Deed

If the pawn stands on the deed, the player answers the question. If s/he gets it right, the deed belongs to that player

If the game has reached the finish line and there are still unclaimed deeds, the player with extra science points will have those deeds.

KnowFind

The words on the white paper are pasted on a light-colored cardboard, an accent-colored cardboard, and a dark cardboard, according to their degree of difficulty.

The game is played with at least two people. Players score points according to the difficulty level of the words (easy:2 points, medium:4 points, difficult:6 points).

Wheel of System Game

After the completion of the educational games implementation process, the teacher candidates held interviews with the students and their parents to whom they applied the educational games. The interviews were based on volunteerism. The interviews were recorded with a voice recorder.

Data Collection Tool

Interview and open-ended questionnaire were used as data collection tools in the study. The researchers created the questions. During the preparation process, all questions were provided to an instructor who was teaching the community service practices course in the primary education department, and the recommendations were received. While the initial question posed to parents was "What do you think

The game starts by turning the wheel. One of the colored cards that appears on the wheel is chosen and the question is read aloud and answered.
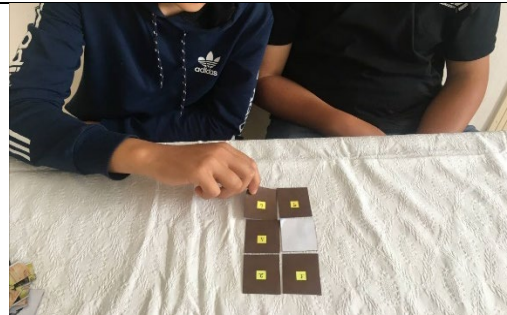

The player who answers the question on the colored card gets the point on the wheel and at the end of the game, the player with the most points wins.

See the Picture and Make a Description

The cards are turned in order, and each time the player is asked if s/he has a guess.

When the picture starts to emerge, the student makes a guess and says its feature.

One More Letter

Prepared questions about acids and bases are asked to the player. The player tries to guess the answer. If the player cannot guess the answer, s/he asks for a letter by saying "one more letter" and a letter is given.
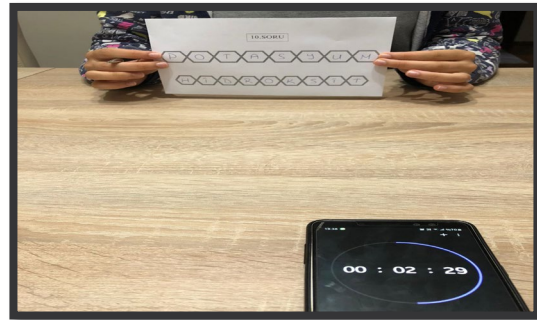
Each time the student asks for a letter, one more letter of the answer is given. The student tries to answer the questions within the given time.
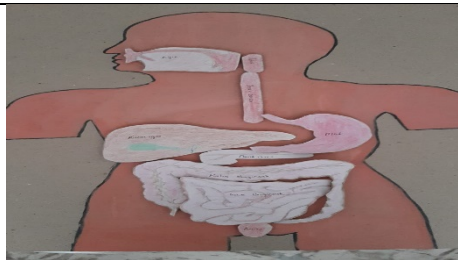
Let's Dart with Science

Players are asked to choose one question and tried to be answered. The player who gives the correct answer throws the arrow and earns the same number of points as the arrow stuck.	The player who answers incorrectly throws the arrow and earns minus points as the arrow is stuck. Player scores are noted.

The Attraction of Our Organs
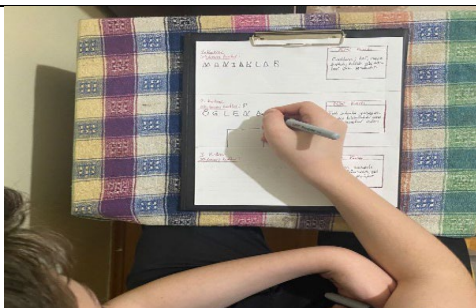
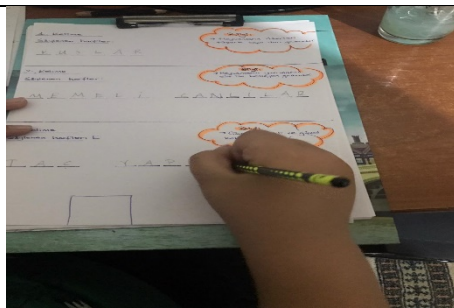|	
In order to make the players understand the organs of the digestive system and their functions, the player tries to place the organ in her/his hand.	The player also tries to give information about the characteristics of the organ.

Let's Build Our House

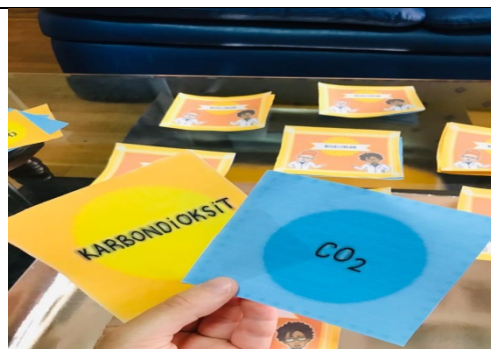|	
First, we draw as many lines as the number of letters for the concepts we have determined in the unit of the living world. If the letters spoken by the players are in the word, we write them on the relevant lines.	If the said letters are not in the word, we start to draw parts of our house. If the player cannot find the word, the teacher can give clues about the word or give the meaning of the word in the dictionary.

Find Your Partner

The cards are laid face up on the table. The game begins with each player choosing two cards. The game continues in this way until the correct match is made. The player who matches correctly tells the use of the compound.	The accuracy of the usage area is checked by looking at the information cards. The game continues in this way until all the cards are matched. At the end of the game, the player with the highest score wins the game.

about the educational game gives?" the question changed based on expert opinion. S/he indicated that the parents would analyze e educational game broadly and that they would be unable to evaluate it personally for their child. S/he specifically mentioned that bringing the child's achievements to the forefront would positively contribute to reflection of the process by the parents. To confirm the clarity of the interview questions, a pilot application was done with a student, parent, and teacher candidate. As a result of the pilot application, "Please explain" part has been added to the question asked of teacher candidates. Because the teacher candidate stated during the pilot application process that the procedure helped him/her, but s/he

did not need to explain, "please explain" section was added to the question. First of all, science teacher candidates were asked to develop their educational games and then implement the educational games with the students at the grade level they prepared. After implementing the educational game, teacher candidates were asked to interview the student and the student's parent. In the interviews, "What did the educational game you played give you?" question has been asked. "What do you think about the educational game gives your child?" questions were posed to the parents. An open-ended questionnaire consisting of a single question was applied to teacher candidates. In the open-ended questionnaire, the teacher candidates were asked, "What kind of contributions the educational game process has for your students? Please explain."

Data Analysis

The data obtained from the interviews and open-ended questionnaire were analyzed by content analysis. The main purpose of content analysis is to discover concepts that can explain the data (Yıldırım & Şimşek, 2005). The transcripts of the data were read in detail before the coding process. Within the scope of content analysis, themes were discovered when the data were coded and categorized. The data was arranged based on themes and codes. The integrity of meaning from the themes drawn from the data was gathered and interpreted in the end. Content analysis was continued by examining the written data again and again. Two distinct coders examined the interview data to ensure the analysis's dependability. Bringing together two distinct coders allowed for the examination of analyses that were done independently of one another. The codes and subsequently the categories were generated by identifying the main and important parts in the examined data. The consistency of the researchers' categories was assessed using an analysis of "coding reliability". Coding reliability was calculated by using the concordance rate index of the categories. The concordance rate is an index determined by calculating the coding situations in which the same coding takes place, the coding cases that were agreed on and those that could not be reached. By using the agreement rate calculated in this way, the consistency value between the encoders was found to be 0.80. The formula $\Delta = C \div (C + \partial) \times 100$ (Δ : Confidence coefficient, C: The number of codes that resulted in agreement, ∂: The number of codes that did not result in agreement) was used to calculate the agreement rate (Miles & Huberman, 1994). The coding that was not agreed upon was resolved by negotiation. The agreement rate used to determine inter-rater reliability is expected to be higher than 0.70 (Tavşancıl & Aslan, 2001). As a result, the coding reliability is at an acceptable level.

The data was analyzed with the help of more than one expert. The appropriateness of naming the determined codes was decided as a consequence of expert discussions. In this manner, it was attempted to check that the correlation between the data and the study questions was accurate. Furthermore, the steps of the research method were detailed. Codes are defined in a way that readers could simply easy reach. Under the research method heading, the relevant information concerning the research model, study group, implementation process and data collection tool is explained in depth. In order to reflect the views of the teacher candidates, students and parents, direct quotations were made and presented to the reader. Code names were given to the participants in terms of research ethics. The opinions of the participants were conveyed using codes without giving their names, on the basis of confidentiality. Student and teacher candidates were given code names and the name of the game was presented as a subscript next to the code name. Likewise, parents were coded as Parent 1,…, Parent 3 and the name of the game was placed as a subscript next to the "Parent" code. For example, the parent of the student playing the Mysterious Planets educational game was coded as "Parent 1 Mysterious Planets".

FINDINGS

Under this title, firstly, the interview question was written, and then the findings obtained from the analysis of the question were included. In the interviews with the students, "What did the educational game you played give you?". The findings obtained for the question are presented in Figure 1.
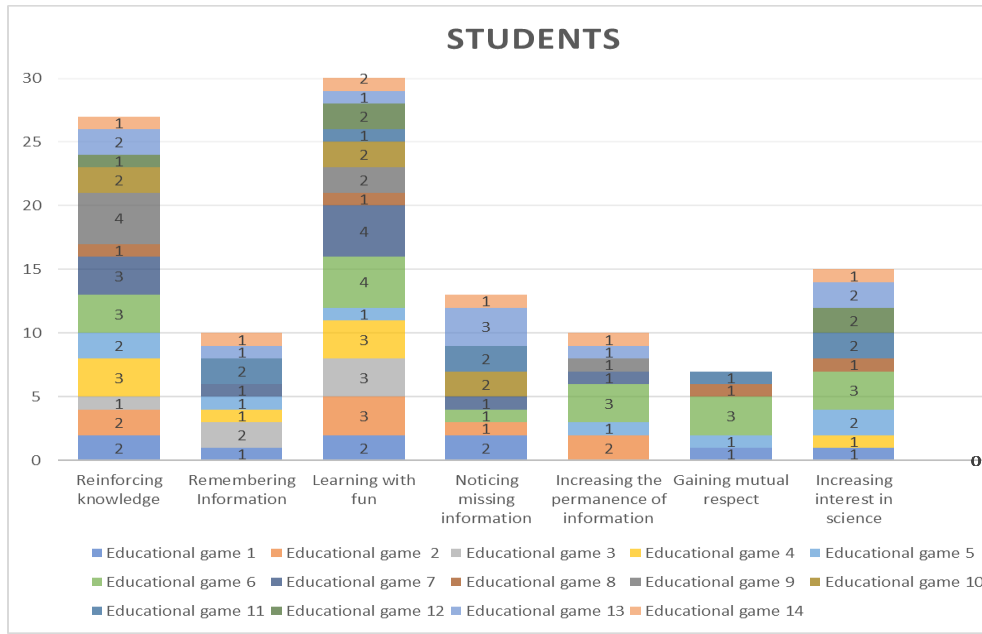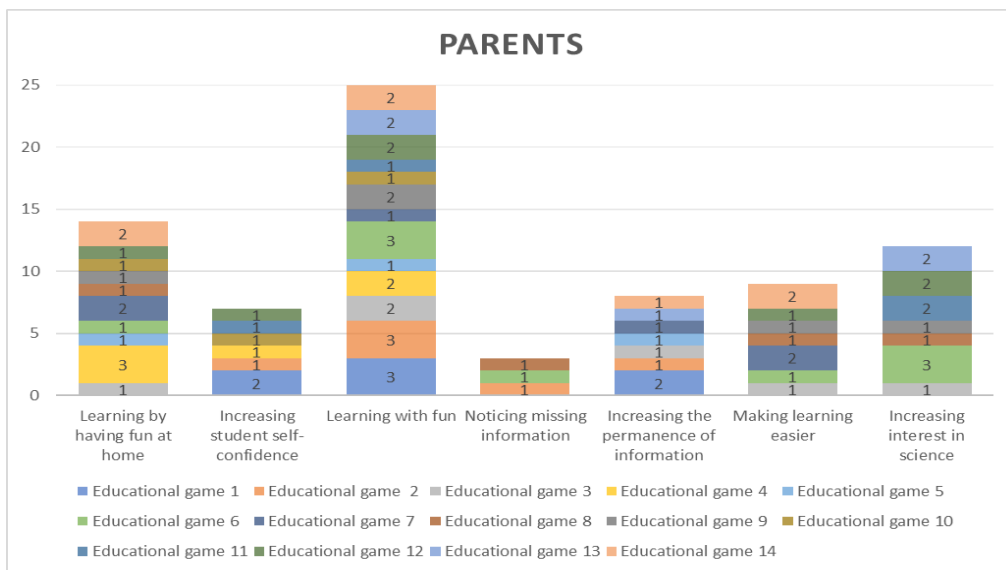
(EG: Educational Games)

Figure 1. *Acquisitions of Students from Educational Games According to Students*

"We have covered this subject beforehand in the course and my knowledge has been reinforced with this game. I was already good at this and didn't have much trouble answering it. Playing such games also increased the memorability of my knowledge. I would love to play games with my friends in the classroom environment. I had never played such games in school before, so it was good for me to play this game. I enjoyed learning by playing games. It's nice to have fun and learn." (Nur ₘₐᵧₘᵢₜ ₩ₕₑₑₗ)

"I had a lot of fun playing the educational game. The game was very enjoyable. I learned concepts that I could not learn and did not know in distance education. My game playing skills have improved. Also, the visuals in the game helped me get to know the concepts. The images were beautiful. I always want to play. I also repeated my information. (Gamze ₘᵧₛₜₑᵣᵢₒᵤₛ ₚₗₐₙₑₜₛ).

Asked in interviews with parents, "What do you think about the educational game gives your child?". The findings obtained for the question are presented in Figure 2.
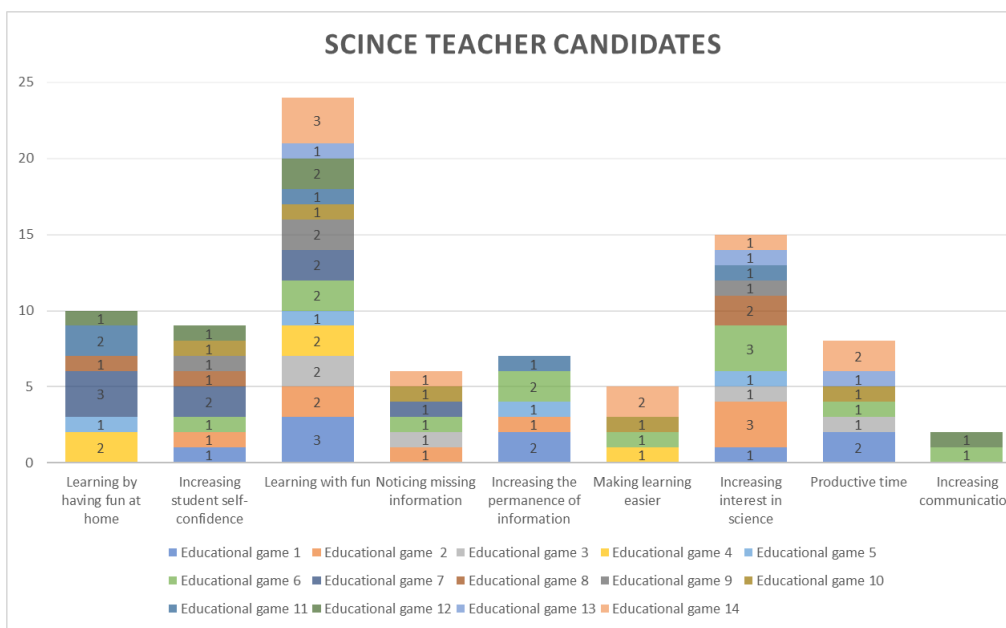

(EG: Educational Games)

Figure 2. *Contribution of Educational Games to Students According to the Parents*

When Figure 2 is examined, it is seen that parents mostly emphasize the "learning with fun" code of educational games. The opinions of some of the parents are presented below.

"My daughter loves to play games. We always want her to play educational games more, but children can play various games. I loved this game as it was educational. The game is not difficult, it is both fun and very instructive. This game was also an idea for our family. She can play the game with all family members at home". (Parent 1 Mysterious Planets)

"I think that because the game prepared is colorful and visually supported, it creates positive feelings for the student. The game can play with family members. Due to the pandemic, students are not going to school. They don't learn much. In this process, I was very happy to see that my child learned while having fun with educational games." (Parent 1 Wheel of Maymit)

In the open-ended questionnaire, the question of "What kind of contributions do you think the educational game process has for your students? Please explain." were asked to the science teacher candidates. The obtained results are presented in Figure 3.

(EG: Educational Games)

Figure 3. *Contribution of Educational Games to Students According to the Science Teacher Candidates*

When Figure 3 is examined, it is seen that the teacher candidates mostly emphasize the "learning with fun" code of educational games. The opinions of some of the teacher candidates are presented below.

"I was excited by the excitement of the student while playing the game. She was happy by winning an award and reinforced her knowledge. This game is an adequate game in terms of permanence of information. I had a lot of fun playing the game and I saw that the student had fun too. A game that teaches with fun, makes it permanent and reinforces knowledge. I never had any trouble making the wheel. It is a wheel assembly that students can easily make and play with simple materials. It should not be forgotten that if the knowledge becomes permanent, something has been achieved. In a way, we aimed for this, and I think we achieved our goal." (Elif Maymit Wheel)

"My student started the game a little reluctantly because he had little to do with the lesson. As she got used to playing, she started to enjoy it a lot. It didn't give me any trouble after that. She wanted more to answer deed questions. Communication between us was very good. After the game, she wanted to play such games on other subjects as well. The sentence that caught my attention the most was the sentence "Will there be a lesson in the game?" I realized there was a misconception at school. Games allow students to learn by attracting their attention. Games should always be in our educational life. Games are very effective in learning. Students love to play games. They do not easily forget a game and the information they have learned." (Elif Know the

_{Question Take the Deed})

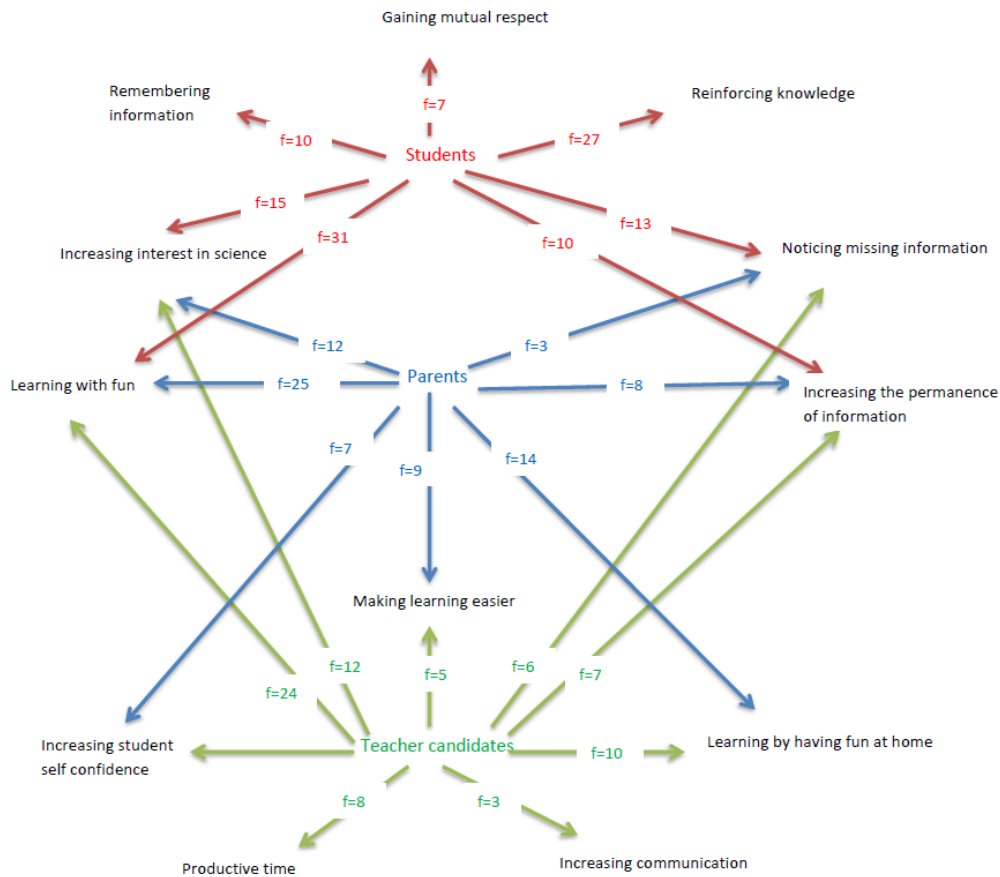In Figure 4, all the codes emphasized by students, parents and teacher candidates are shown.

Figure 4. *Contribution of Educational Games to Students According to Students, Parents and Science Teacher Candidates*

When Figure 4 is examined, it is seen that the codes of "increasing interest in science lessons, recognizing missing information, learning with fun and increasing the permanence of information" are emphasized by students, parents and science teacher candidates.

DISCUSSION

This study aimed to evaluate the educational games implementation process from the science teacher candidates, students and their parents perspective. The students evaluated the educational games as "learning with fun" by using the expressions of both learning and fun. Students' emphasis on learning through play rather than playing games or having fun coincides with the purpose of educational games as "learning through play rather than learning to play". In addition, this statement of the students can be interpreted as learning science by being in an entertainment environment. The fact that students mostly emphasized the "learning by having fun" code regarding the implementation process of educational games also shows parallelism with the theoretical background of the adoption of games in the education field. Educational games include both game content and a fun and active learning environment that includes learning (Arkün Kocadere & Samur, 2016; Burgaz Uskan & Bozkuş, 2019; Lameras et al., 2017). In addition, educational games in science education are a method that requires the student to participate in an entertaining environment as a player while learning (Sánchez-Martín et al., 2017). Therefore, students' examination of educational games as learning by having fun is in line with the main objectives of adopting educational games in education. Similar to the evaluations of the students, parents and science teacher candidates also emphasized that educational games are fun and instructive. The fact that both teacher candidates and parents find educational games the most entertaining and instructive points to the aims of educational games. Such evaluations of the parents may be due to the fact that they personally saw the implementation phase of

educational games. Parents' emphasis on the instructive aspect can also be a pleasing result. Because before introducing a game prototype, parents may have misunderstandings about the games and therefore perceive the games negatively (Xie, 2021). Therefore, this study may have enabled parents to see the differences between educational games and games.

Students think that the educational games make it possible to reinforce the knowledge they have learned. Educational games are included in the education system to reinforce the concepts learned in lessons (Dumlu Güler, 2011; Tural, 2005). The definition of educational games in the education dictionary as "teaching techniques that enable the reinforcement of the learned information and the repetition of it in a more comfortable environment" (Demirel, 2010) may indicate that the educational games applied to the students in this study serve the purpose. From a different point of view, it is understood that the educational games designed by the science teacher candidates are reinforcing the knowledge according to the students' views. Students' statements that they reinforce the knowledge may indicate that the science teacher candidates paid attention to reinforcing the subject while designing the educational games. Additionally, the findings of this study are consistent with teachers preferring to employ the game in classrooms since it offers permanent learning (Özyürek & Çavuş, 2016). As a matter of fact, in the studies, teacher candidates and teachers pay attention to issues such as the fact that the game is fun, it is related to the subject, it is educational and instructive, it is remarkable, its rules are understandable, it is applicable in the classroom environment, and it reinforces the subject (Akcanca & Sömen, 2018). Furthermore, while studies show that teacher candidates struggle to find, develop, and implement educational games in their subject areas (Akcanca & Sömen, 2018; Demir et al., 2012), in this study science teacher candidates use educational games to reinforce knowledge. Most students' attention on reinforcing information may be attributed to the fact that science teacher candidates use educational games to reinforce knowledge after teaching the topic.

Unlike the students, the parents and teacher candidates evaluated the subject as "repeating the subject by having fun". Parents and teacher candidates may state that students have fun at home thanks to educational games, since students passed all time at home during the pandemic. Since parents state that students are bored, inactive and their days become monotonous during this period (Akgül & Oran, 2020; Başaran et al., 2020; Okatan & Tagay, 2021). Besides, repeating the subject is seen as boring, difficult and time-consuming (Osborne & Collins, 2001) by the students, so students are generally reluctant to repeat the learned information. Therefore, the opinions of parents and teacher candidates in the form of "repeating the subject by having fun" rather than "repeating the subject" can be interpreted as educational games make this process entertaining.

The students stated that they enjoy learning by playing games. Studies indicate that rote-based teaching will reduce students' interest and desire for science (Honey & Hilton, 2011; Mayo, 2007). If a person enjoys his work and expresses his/her pleasure clearly, it means that real learning has taken place (Engin et al., 2004). From this point of view, the fact that students enjoy learning by playing educational games and express it, may show that real learning took place. Although the reasons of the preference of educational games for any course are comprehensive, the reasons for choosing educational games are even wider when it comes to science education, because science course requires an extra motivational support (Xie & Reider, 2014). The more motivated student is to learn science when they have good views regarding the scientific lecture (Bergin & Relly, 2005; Yılmaz & Huyugüzel Çavaş, 2007). Educational games are preferred to make science more interesting and understandable and to create positive feelings towards science (Mellado et al., 2014).

The results of the parent dimension are based on the observations of the parents. Parents stated that students' interest in the lesson increased by playing games. This situation shows that parents have a positive attitude towards traditional educational games, which is the opposite of the results of some studies (Nikken & Jansz, 2006). In fact, the decrease in students' interest in the lesson due to the lack of communication during the pandemic may have been eliminated through the educational games. On the other hand, this result is in line with parents' positive remarks in Genç Ersoy's (2021) study concerning educational games, which include that they provide basic learning, language skill development, and support for higher-order thinking abilities.

Some science teacher candidates emphasized that the interest in science. The power of games can be

used to both attract students' attention and achieve desired educational goals by matching the instructional content with certain game features (Burgaz Uskan & Bozkuş, 2019; Garris et al., 2002). The fact that the science teacher candidates highlighted that the interest in science revealed an important difference between teaching with educational games and other teaching methods (Demir, Önen & Şahin, 2012). From there, it can be interpreted that the science teacher candidates blended the game components with the science subject content so they designed interesting educational games for the subject. The presence of similar themes in the dimensions of teacher candidates and parents in parallel with the evaluations of the students indicates that educational games will solve the problem of decreased interest in science (Aycan et al., 2002; Buckley et al., 2017; Can & Yıldırım, 2017). For this reason, the idea that teaching with games can be realized in science education and that it can be effective in attracting students' attention to science seems to be emphasized once again by parents, science teacher candidates and students. In addition, the opinions of different relaters on the common ground confirm the contribution of the games to children.

CONCLUSION

Findings show that students, teacher candidates and parents agree on common points. Both students, science teacher candidates and parents emphasized that they learned by having fun and their interest in the lesson increased. Besides, students and teacher candidates stated that educational games increase the permanence of knowledge. The parents, on the other hand, stated that the students had a productive time thanks to the educational games. More entertaining and instructive aspects of educational games were emphasized by all three groups. The fact that educational games are more effective than entertaining, is one of the important differences that distinguishes educational games from games. Although all three participant groups in the study found the educational games both entertaining and instructive, the incomparability of their entertaining and instructive aspects may indicate a lack in the study. For this reason, it is recommended to determine which side are more dominant in future applied studies. It is thought that the lack of feedback from students or other relaters in terms of group play is due to the application of the study during the pandemic process. For this reason, it can be recommended to apply this study as a group in the classroom and to evaluate educational games in this way.

REFERENCES

Akçanca, N., & Sömen, T. (2018). Prospective teachers' educational game designing and applications. *Turkish Studies Educational Science*, *13*(27), 49-71.

Akgül, G., & Oran, M. (2020). Vıews of socıal studıes teachers, of mıddle school students and student parents about dıstance educatıon durıng the pandemıc process . *Journal of New Approaches in Education, 3*(2), 15-37.

Arkun Kocadere, S., & Samur, Y. (2016). Game to gamification. İ. Aytekin, F. O. Hatice, & A. Buket (Ed.), In *Educational technology readings* (pp. 397‑415). TOJET-Salmat Publishing.

Arztmann, M., Hornstra, L., Jeuring, J., & Kester, L. (2022). Effects of games in STEM education: a meta-analysis on the moderating role of student background characteristics. *Studies in Science Education*, 1-37.

Aycan, Ş., Kaynar, Ü. H., Türkoğuz, S., & Arı, E. (2002, September 16-18). İlköğretimde kullanılan fen bilgisi ders kitaplarının bazı kriterlere göre incelenmesi [Examining the science textbooks used in primary education according to some criteria]. [Conference presentation]. In *V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Ankara, Türkiye* (pp.246-252). https://silo.tips/download/v-ulusal-fen-blmler-ve-matematk-etm-kongres-eyll-2002-odt-kltr-ve-kongre-merkez

Başaran, M., Doğan, E., Karaoğlu, E., & Şahin, E. (2020). A study on effectıveness of dıstance educatıon, as a return of coronavırus (COVID-19) pandemıc process. *AJER*, *5*(2), 368-397.

Bergin, S. & Reilly, R. (2005). *The infuence of motivation and comfort-level on learning to program*. In Proceedings of the 17th workshop on psychology of programming-PPIG'05 (pp. 293–304).

Buckley, P., Doyle, E., & Doyle, S. (2017). Game on! Students' perceptions of gamified learning. *Journal of

Educational Technology & Society, *20*(3), 1-10.

Buzgaz Uskan, S. & Bozkuş, T. (2019). Eğitimde oyunun yeri. *Uluslararası Güncel Eğitim Araştırmaları Dergisi*, *5*(2), 123-131.

Can, S., & Yıldırım, M. (2017). Eğitsel oyunlarla fen dersine "Var mısın yok musun?". *Atatürk Üniversitesi Kazım Karabekir Eğitim Fakültesi Dergisi,* 35, 14-30.

Chen, P. Y., Hwang, G. J., Yeh, S. Y., Chen, Y. T., Chen, T. W., & Chien, C. H. (2021). Three decades of game-based learning in science and mathematics education: an integrated bibliometric analysis and systematic review. *Journal of Computers in Education*, 1-22.

Cheng, M. T., Chen, J. H., Chu, S. J., & Chen, S. Y. (2015). The use of serious games in science education: a review of selected empirical research from 2002 to 2013. *Journal of Computers in Education*, *2*(3), 353-375.

Cop, M. R., & Kablan, Z. (2018). Türkiye'de eğitsel oyunlarla ilgili yapılmış çalışmaların analizi. *Kocaeli Üniversitesi Eğitim Dergisi, 1*(1), 52-71.

Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, *59*(2), 661-686.

Corredor, J., Gaydos, M., & Squire, K. (2014). Seeing change in time: Video games to teach about temporal change in scientific phenomena. *Journal of Science Education and Technology*, *23*(3), 324-343.

Çepni, S. (2007). *Araştırma ve proje çalışmalarına giriş*. Celepler.

De Freitas, S. (2006). *Learning in Immersive worlds: A review of game-based learning*. Retrieved from https://researchrepository.murdoch.edu.au/id/eprint/35774/1/gamingreport_v3.pdf

Demir, S., Önen, F., & Şahin, F. (2012, June 27-30). *Fen bilgisi öğretmen adaylarının yapılandırmacı yaklaşımı uygulamaya yönelik öz yeterlilik inanç düzeylerinin belirlenmesi üzerine bir araştırma* [A study on determining the self-efficacy belief levels of pre-service science teachers towards applying the constructivist approach]. X. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Niğde, Türkiye (pp.2050-2070).

Demircioğlu, H., & Akdemir, M. S. (2019). Teaching the topic of states of the matter by using the educational games. *The Journal of International Social Research, 12*(64), 540-547.

Demirel, O. (2010). *Eğitim sözlüğü*. Pegem.

Denscombe, M. (1998). *The good research guide*. Open University.

Dumlu Güler, T. (2011). *6. sınıf fen ve teknoloji dersindeki hücre ve organelleri' konusunun eğitsel oyun yöntemiyle öğretilmesinin öğrencilerin akademik başarisina etkisi* [Yüksek lisans tezi]. Atatürk University, Erzurum.

Ekiz, D. (2015). *Bilimsel araştırma yöntemleri.* Anı.

Engin, A. O., Seven, M. A., & Turhan, V. N. (2004). The place and importance of games in learning. *Atatürk University Journal of the Institute of Social Sciences, 4*(2), 109-120.

Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. *Simulation and Gaming, 33*(4), 441-467.

Genç Ersoy, B. (2021). Türkçe öğretiminde eğitsel oyun kullanımı: Bir meta-tematik analiz çalışması. *Ana Dili Eğitimi Dergisi, 9*(2), 510-530.

Güler, C., & Güler, E. (2015). Gamification in online learning environment: The use of badge. *Journal of Research in Education and Teaching, 4*(3), 125-130.

Hamden Hamid, S., Zulkiply, N., & Mohamad, F. S. (2022). The effects of non-digital game-based learning and cognitive level of questions on isometric transformations. *Asian Journal of University Education*, *18*(1), 34-50.

Hodson, D. (2014). Learning science, learning about science, doing science: Different goals demand different learning methods. *International Journal of Science Education*, *36*(15), 2534-2553.

Hoffman, B., & Nadelson, L. (2010). Motivational engagement and video gaming: A mixed methods study. *Educational Technology Research and Development*, *58*(3), 245-270.

Honey, M. A., & Hilton, M. L. (2011). *Learning science through computer games.* National Academies Press.

Jack, B. M., & Lin, H.-s. (2017). Making learning interesting and its application to the science classroom. *Studies in Science Education, 53*(2), 137-164.

Kinzie, M. B., & Joseph, D. R. D. (2008). Gender differences in game activity preferences of middle school children: Implications for educational game design. *Educational Technology Research and Development*, *56*(5), 643-663.

Lameras, P., Arnab, S., Dunwell, I., Stewart, C., Clarke, S., & Petridis, P. (2017). Essential features of serious games design in higher education: Linking learning attributes to game mechanics. *British Journal of Educational Technology, 48*(4), 972-994.

Lester, J. C., Spires, H. A., Nietfeld, J. L., Minogue, J., Mott, B. W., & Lobene, E. V. (2014). Designing game-based learning environments for elementary science education: A narrative-centered learning perspective. *Information Sciences*, *264*, 4-18.

Li, Y., Huang, Z., Jiang, M., & Ting-Wen, C. (2016). The effect on pupils' science performance and problem-solving ability through Lego: An engineering design-based modeling approach. *Journal of Educational Technology & Society, 19*(3), 143-156.

Lin, C. H., Liu, E. Z. F., Chen, Y. L., Liou, P. Y., Chang, M., Wu, C. H., & Yuan, S. M. (2013). Game-based remedial instruction in mastery learning for upper-primary school students. *Journal of Educational Technology & Society*, *16*(2), 271-281.

Mayo, M. J. (2009). Video games: A route to large-scale STEM education? *Science, 323*(5910), 79–82.

Mellado, V., Belen Borrachero, A., Brigido, M., Melo, L. V., Antonia Davila, M., Canada, Florentina, ... & Luisa Bermejo, M. (2014). Emotions in science teaching. *Enseñanza de las Ciencias*, *32*(3), 11-36.

Nikken, P., & Jansz, J. (2006). Parental mediation of children's videogame playing: A comparison of the reports by parents and children. *Learning, Media and Technology*, *31*(2), 181-202.

Osborne, J., & Collins, S. (2001). Pupils' views of the role and value of the science curriculum: A focus-group study. *International Journal of Science Education*, *23*(5), 441-467.

Okatan, Ö., & Tagay, Ö. (2021). İlkokul velilerinin görüşlerine göre COVID-19 pandemisi. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *17*(2), 309-328.

Özyürek, A., & Çavuş, Z. S. (2016). İlkokul öğretmenlerinin oyunu öğretim yöntemi olarak kullanma durumlarının incelenmesi. *Kastamonu Eğitim Dergisi*, *24*(5), 2157-2166.

Piaget J. (1962). *Play*, d*reams and imitation in childhood*, *etc*. Kegan Paul.

Plass, J. L., Homer, B. D., & Kinzer, C. K. (2015). Foundations of game-based learning. *Educational Psychologist*, *50*(4), 258-283.

Qian, M., & Clark, K. R. (2016). Game-based learning and 21st century skills: A review of recent research. *Computers in Human Behavior, 63*, 50–58.

Riopel, M., Nenciovici, L., Potvin, P., Chastenay, P., Charland, P., Sarrasin, J. B., & Masson, S. (2019). Impact of serious games on science learning achievement compared with more conventional instruction: An overview and a meta-analysis. *Studies in Science Education*, *55*(2), 169-214.

Sánchez-Martín, J., Cañada-Cañada, F., & Dávila-Acedo, M. A. (2017). Just a game? Gamifying a general science class at university: Collaborative and competitive work implications. *Thinking Skills and Creativity*, *26*, 51-59.

Sung, H. Y., & Hwang, G. J. (2013). A collaborative game-based learning approach to improving students' learning performance in science courses. *Computers & Education*, *63*, 43-51.

Şentürk, C. (2020). Oyun temelli fen öğrenme yaşantılarının akademik başarıya, kalıcılığa, tutuma ve öğrenme sürecine etkileri. *Milli Eğitim Dergisi*, *49*(227), 159-194.

Tavşancıl, E., & Aslan, A. E. (2001). *Sözel, yazılı ve diğer materyaller için içerik analizi ve uygulama örnekleri* Epsilon.

Tsai, Y. L., & Tsai, C. C. (2020). A meta-analysis of research on digital game-based science learning. *Journal of Computer Assisted Learning*, *36*(3), 280-294.

Tural, H. (2005). *İlköğretim matematik öğretiminde oyun ve etkinliklerle öğretimin erişi ve tutma etkisi* [Yayımlanmamış yüksek lisans tezi]. Dokuz Eylül Üniversitesi.

Wang, L. H., Chen, B., Hwang, G. J., Guan, J. Q., & Wang, Y. Q. (2022). Effects of digital game-based STEM education on students' learning achievement: A meta-analysis. *International Journal of STEM Education*, *9*(1), 1-13.

Wang, M., & Zheng, X. (2021). Using game-based learning to support learning science: A study with middle school students. *The Asia-Pacific Education Researcher*, *30*(2), 167-176.

Wellington, J. (2000) *Practical work in school science- Which way now?* .Routledge.

Wu, W. H., Hsiao, H. C., Wu, P. L., Lin, C. H., & Huang, S. H. (2012). Investigating the learning-theory foundations of game-based learning: A meta-analysis. *Journal of Computer Assisted Learning*, *28*(3), 265-279.

Xie, J., Wang, M., & Hooshyar, D. (2021). Student, parent, and teacher perceptions towards digital educational games: How they differ and influence each other. *Knowledge Management & E-Learning: An International Journal*, *13*(2), 142-160.

Xie, Y., & Reider, D. (2014). Integration of innovative technologies for enhancing students' motivation for science learning and career. *Journal of Science Education and Technology, 23*(3), 370-380.

Yıldırım, A. & Şimşek, H. (2005). Sosyal bilimlerde araştırma yöntemleri. Seçkin.

Yıldız, E., Şimşek, Ü., & Ağdaş, H. (2017). Eğitsel oyun entegre edilmiş işbirlikli öğrenme modelinin öğrencilerin fen öğrenimi motivasyonları ve sosyal becerileri üzerine etkisi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *18*(2), 37-54.

Yılmaz, H., & Huyugüzel Çavaş, P. (2007). Fen öğrenimine yönelik motivasyon ölçeğinin geçerlik ve güvenirlik çalışması. *İlköğretim online*, *6*(3), 430-440.

Yien, J. M., Hung, C. M., Hwang, G. J., & Lin, Y. C. (2011). A game-based learning approach to improving students' learning achievements in a Nutrition course. *Turkish Online Journal of Educational Technology-TOJET*, *10*(2), 1-10.