

THE PLACE OF GAME IN PRIMARY SCHOOL MATHEMATICS TEACHING AND DIGITAL GAME TOOLS

Dr. Ayşegül BÜYÜKKARCI

aysegulbuyukkarci@sdu.edu.tr

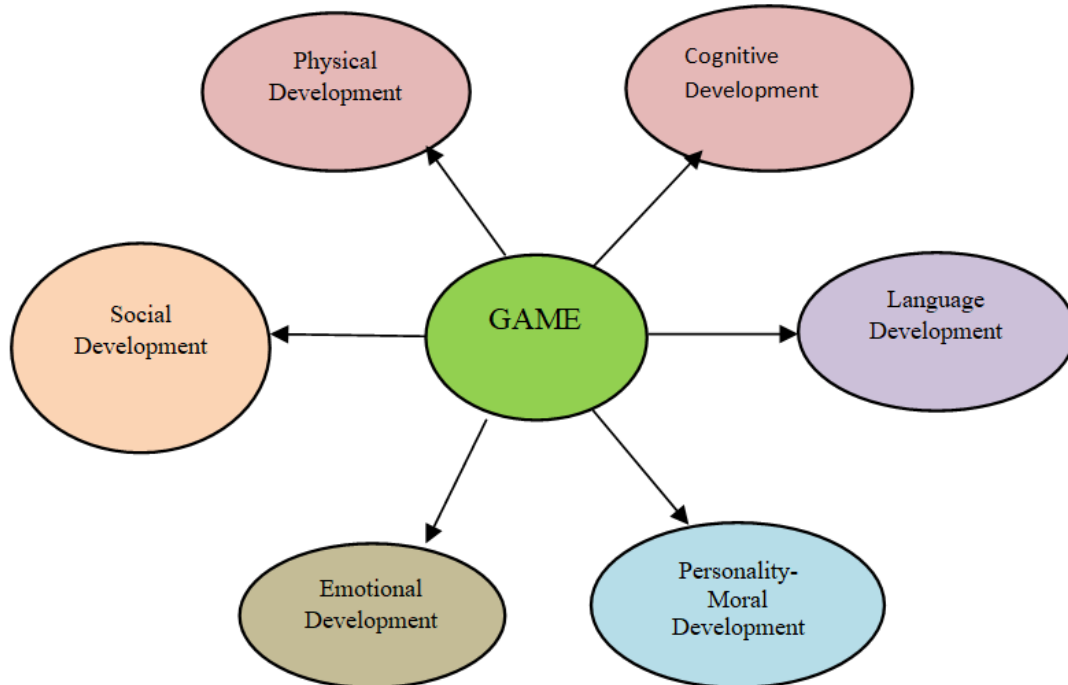
Süleyman Demirel University, Turkey

INRODUCTION

1. Definition of Game, Its Place in Children's Development and Education

The game stimulates all areas of development (language, mind, social, emotional, physical, personality and moral development) positively and forms the basis for the acquisition of skills (Tuğrul, 2015). Children develop social skills, thinking and life skills through play. Reflecting his/her life and thoughts in the game, the child feels free and happy in the game environment. A free and happy child can express himself without fear. In Figure 1, the areas affected by the game are given as titles.

Figure 1: Development Areas Affected by the Game



Physical development: Jumping, balancing, carrying, etc. that the child performs during the game. Movements that require physical strength not only support motor development, but also help organs work regularly. Generally, outdoor games support the motor development of large muscles. In the motor development of small muscles, the child, who used his/her hands randomly before, now uses it purposefully. In the game, he/she gains

many skills such as holding scissors, buttoning, drawing with a pencil.

Social and emotional development: Game has an important place in terms of personality development and emotional development. The child learns some of his/her life experiences from the game or adds roles from his/her own life experience to the game. Waiting his/her turn during the game, taking responsibility for the role he/she takes, developing empathy with the role he/she takes makes the child more ready for life. Play is a way of relaxation for the child. Both an angry child's discharge of energy and a happy child's full of energy can be achieved through play, which is a healthy process. The child recognizes and trusts people in the game or has the opposite feeling. By choosing to take risks from time to time, the child experiences life in a micro sense.

Cognitive development: Game supports the child's problem solving, imagination and perception skills. In particular, symbolic play, which is widely used by children, has a great contribution. It is stated that symbolic play contributes to children's reading comprehension, awareness of abstract concepts and providing mathematical skills (Ailwood, 2010; Anita, 2006; Tuğrul, 2015). In addition to this, the child follows a certain order by moving in accordance with the rules of the game during the game. Makes mental comments about what they know and what they add new.

Language development: Games with dialogue, rhymes and songs help the child reach language proficiency by expanding their vocabulary. The child who can express himself/herself comfortably in the game environment is expected to have the same attitude in social life.

Personality and moral development: Children's personality traits can be easily identified during the play process (Pehlivan, 2016). The child who wants to be involved in the game can make some changes in himself/herself by making use of his/her observations. By making use of his/her observations in the game, he/she can soften his combative, incompetent aspects in order to be accepted by the society. It has the opportunity to experience tendencies such as reacting to injustice that may occur in the game. Especially in games with rules, the child may choose to shape his own behavior.

The contribution of the game to education is a fact known for centuries. Bandura, Erikson, Piaget, Vygotsky are just a few of the leading scientists who argue that the game contributes to education. Many rules that are difficult to teach a child can be taught more easily during play. Children unconsciously learn and adopt many rules and concepts such as decision making, ordering, arranging, learning, cooperation, sharing, helping others, and respecting the rights of others (Hoşgör, 2010). The educational benefits of the game can be listed as follows:

- It provides improvements in concept and skill acquisition.
- Learning becomes fun.
- It enables students to be active in the lesson.
- It provides an increase in communication between students.
- Encourages students to explore and examine.
- It enables the development of what has been learned
- It enables children to take risks and experiment.
- Offers the opportunity to work collaboratively.
- It enables him to apply the acquired skills (Uskan and Bozkuş, 2019).

Hutchings (2012), Sanford and Madill (2007) and Burguillo (2010) stated the success of the game in education in their studies. Some of these studies are as follows:

Sanford and Madill (2007) investigated the use of games in peer education. Trainers aged 11-16 were selected as peer educators and students were selected from primary school level. Researchers observed the lectures and conducted group sessions. As a result of the study, it was stated that the game is an "art" with many uses, rather than a lesson tool used to educate young people.

Burguillo (2010) investigated the effects of competition-based games on the classroom environment, students' motivation and their success. In this study, which was conducted with students whose average age is 20, it was concluded that the game played in the competition environment increased the motivation of the students. In addition, among the other results stated that the game provides positive contributions in terms of cooperative learning in the group, active participation of the students in the lesson, and self-discovery, as well as being beneficial in mathematics and artificial intelligence techniques.

Hutchings (2012) aimed to find the effects of the game in the field of education in his study. For this purpose, thirty studies in the field of education with games in primary, secondary universities and vocational education institutions were critically examined. As a result of the study, it was concluded that the games used as a planning and thinking method increased the motivation of both students and teachers. In addition, it was stated that this increase in motivation occurred not only in children but also in adult students.

In line with the studies, the game can be counted as one of the main techniques used to be more active in the education-teaching process. As a matter of fact, researchers have stated that children can learn the information they have experienced more easily and permanently instead of the information transferred directly (Tuğrul, 2015).

2. Game and Mathematics Teaching

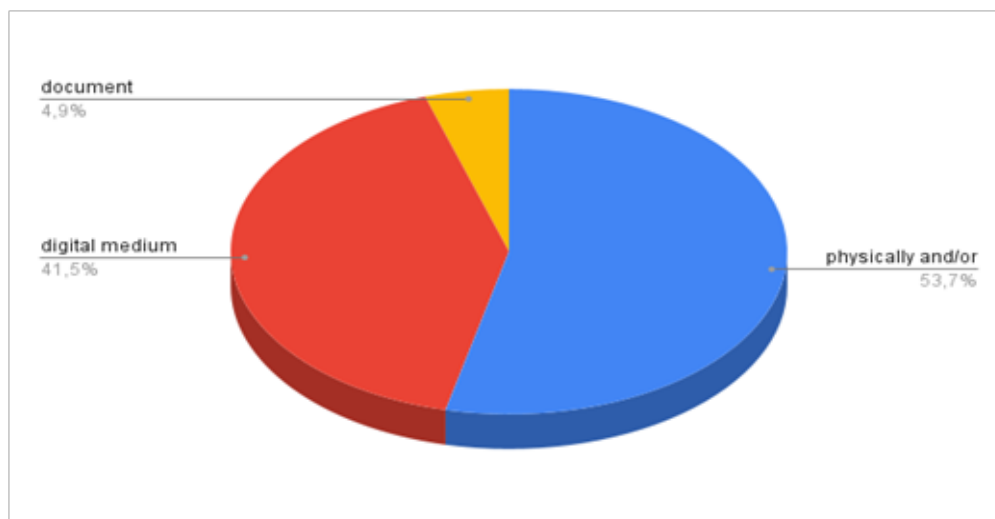
Today, science and natural sciences cover all scientific functions that can help human nature and studies that reveal them in line with predetermined goals. For centuries, humankind's curiosity about the events on earth and the effort to understand them has led them to be more interested in science day by day. From the past to the present, some of the branches of science considered to be the most important by people are mathematics, geometry, astronomy and medicine. The most important way of transferring science is education. Societies have given importance to education, which is the most effective way of transferring their knowledge to future generations. Education has been seen as a means of reaching the more beautiful, catching and exceeding the age. Therefore, education has gained importance.

In today's conditions, it is expected that the students who are educated in our education system have the ability to criticize, produce creative ideas, think multi-dimensionally and solve problems. In order to raise such students, mathematics teaching is also very important along with other courses. In this sense, the education given to the individual is also changing and developing in order to meet the learning needs of the individual who is trying to keep up with the developing technology.

Today, education moving away from giving ready-made information; it aims to raise individuals who can discover and acquire knowledge by researching (Güneş, 2010). At the point of experiencing difficulties in learning some lessons and perceiving those lessons as difficult; the methods and techniques used in education need to be revised, developed and renewed with criteria in the light of new theories. In the mathematics course, which is seen as one of the courses that is perceived as difficult today, it is a subject that should be investigated under which heading is difficult or missing. Many factors such as teacher characteristics (Toptaş et al., 2012), student readiness, method and technique of the lesson, applied curriculum (Ursini & Sánchez, 2008), measurement and evaluation can affect the success of the course. Determining the teaching methods and techniques suitable for the child is necessary for the success of the education. It is possible to determine the methods and techniques that will be beneficial in the game environment. The completely natural behavior of the student in the game environment will provide a resource for the teacher to make ideas about him/her. This observation will also be effective in determining the method and technique according to the students. In the light of the fact that the methods and techniques used have an important place in mathematics teaching, it is thought that teaching with games will be an alternative and will make the lesson fun and increase academic success. Games and activities are also important in terms of ensuring that learning is active and permanent by putting the student in the center (Güneş, 2010).

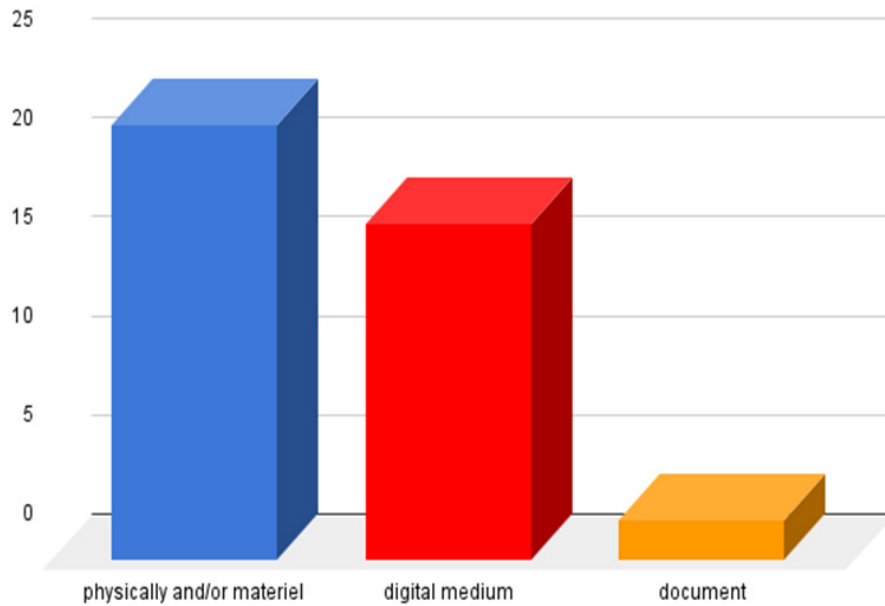
It is a known fact that children at primary school level are keen on playing games. Play is a fun activity in which children develop and train themselves in many ways while having fun. Students' learning by having fun will provide a basis for putting the acquired knowledge into a logical framework and for the child in competition to take his/her job seriously with a sense of responsibility and to provide full motivation. Learning games will be beneficial in contextualizing the course content and students applying it to their real lives (Abrams, 2009). There are some rules that take place within the scope of games, whether it is physical games or games that take place in digital environments. Within these rules, sorting, collecting points, sharing, finding the difference, etc. Many game rules support the achievements associated with mathematics lessons. Thus, the child can learn mathematics with pleasure in the game. He can also do his trial and error in the game environment without fear. As a matter of fact, there are studies in which the attitude towards the lesson and success are related to each other (Sarpkaya et al., 2011; Tabuk, 2019; Yenilmez, 2007). There are many studies on the use of games in teaching mathematics. Both in Turkey and in other countries, 41 studies examining the game in various ways in mathematics teaching have been reached. The content of the games used in the studies were examined and divided into two game types. One of them is the "digital medium", which provides an environment for the use of video or animation; computer, phone, tablet etc. There are types of games that require technical equipment, and the other are games with "physical and/or material" content that require the use of materials (papers, pens, beads, sticks, etc.) along with the physical strength of the children. The percentage distributions of the studies regarding the use of games in mathematics teaching are given in Figure 2, and the column chart is given in Figure 3.

Figure 2: Percentage Distribution of Studies on the Use of Games in Mathematics Teaching



As can be seen in Figure 2, 53.7% of the studies consist of games that require physical power and/or make the use of materials active. The share of 41.5% includes games that take place in the digital environment. The 4.9% distribution belongs to studies with literature review.

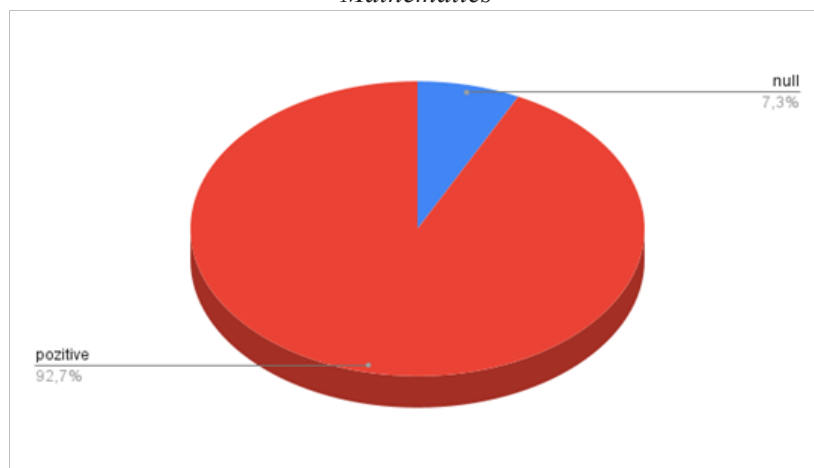
Figure 3: Column Chart Distribution of Studies on the Use of Games in Teaching Mathematics



As can be seen in Figure 3, 22 of the studies involving the use of games in mathematics teaching are studies involving the use of "physical and/or material". 17 studies are game-based studies that take place in the "digital medium", and two studies constitute the review of the literature.

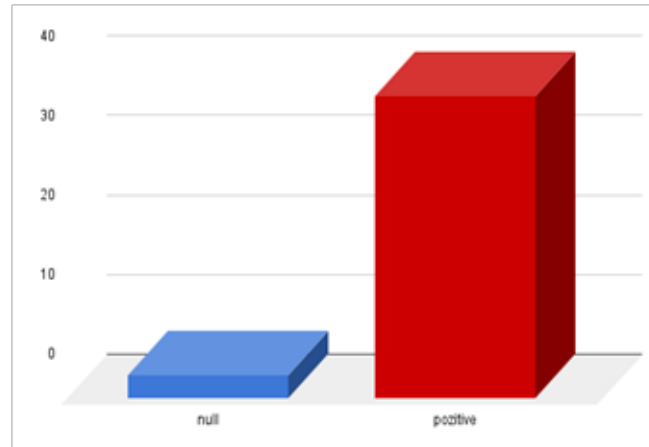
When the studies were examined, it was found that the different games used in teaching mathematics led to changes in students' achievements, motivations, attitudes and student outcomes. In the findings, the use of the game method in the mathematics lesson was examined and the effect of the student's attitude and success in at least one variable was evaluated as positive, while those who did not show any effect were noted as "ineffective". The positive or ineffective percentage distribution of the effects of the studies on student achievement and attitude is given in Figure 4 and the column chart is given in Figure 5.

Figure 4: Distribution of Positive and Ineffective Results of Game Studies in Teaching Mathematics



As seen in Figure 4, 92.7% of the studies on the use of games in mathematics teaching showed that at least one of the students' "attitude and/or success" resulted positively. A share of only 7.3% showed that the use of games in mathematics teaching did not show any change in the variables of "attitude and/or success", that is, the use of games remained "ineffective".

Figure 5: Column Chart Distribution of Positive and Ineffective Results of Game Studies in Teaching Mathematics



As shown in Figure 5, 38 of the studies on the use of games in mathematics teaching revealed a positive result in the "attitude and/or success" variable, while only three showed no change in any direction. This can be interpreted as the use of games in mathematics teaching will be a powerful method. The game in line with the results of the study; It can be accepted as a method that will be preferred in terms of affecting students' attitudes and success to a great extent and learning mathematics subjects by having fun.

It is seen that general teaching method techniques were used in primary education programs in Turkey, especially before the 2005 program. Among the methods used, there is mainly the narrative method. However, it is seen that the methods and techniques used in mathematics teaching have changed from year to year, and methods that can make students more active have begun to take place. In the 2005 Program, the teacher-centered teaching method was replaced by student-centered education. The adoption and implementation of the constructivist approach is seen in the teacher's guidebooks of the Ministry of National Education [MEB] in Turkey. In the guidebooks, besides the guidance on what the teacher can do, which tools will be needed during the activities is also listed. Thus, teachers can easily use these planned activities to activate the student. However, there may be some limitations in the application of game-based teaching in the classroom (Uskan & Bozkuş, 2019). In crowded classrooms, distance from the target, noise, and weaknesses in the teacher's control of the class may occur. It is important to plan the game correctly and implement it at the right time. A lot of effort falls on the teacher in the face of the problems encountered in practice. For this reason, it may be that it is not among the preferences of many teachers and instead traditional methods are used. However, it is important for the teacher to know that the knowledge consisting of experience cannot be

used healthily by the students during the application phase. Because of this situation, it will make the teacher willing to take an active part in the lesson.

3.Digital Game Tools That Can Be Used in Mathematics Teaching in the 21st Century

Although it is known that the games in which children take part both physically and spiritually will never lose their value, digital games are preferred recently. Digital games prepared for educational purposes contribute to the teaching of lessons and the teaching of concepts related to daily life. During the Covid-19 pandemic period, which the whole world was exposed to, students continued their lives and learning under home conditions. In these conditions, digital tools used for learning have gained a lot of popularity. In this process, digital games have affected their attitudes such as having fun in the lesson and liking the lesson, as well as obtaining the achievements related to the lesson. Digital environments are more in demand to make the lesson more fun and effective. Digital applications and web 2.0 tools have been created to be used in almost all courses. These web tools and applications have been tried to be developed in such a way that they can be used in the course of drawing attention, measuring, and teaching in the course. It has offered a versatile use in order to provide concept maps, digital stories, presentations, and measurement tools to be used in lessons or in daily life. Coding tools (Blockly, Coder Org., Scratch, Code.org, Algo Digital, Code Monkey, Kodable, Code club, Tynker, Blockly, Strach, Strach Jr Alice, Microsof Small Basic, Khan Academy, Coder Dojo, Microworlds JR), Web 2.0 tools and various digital applications (Kahoot, Slidely, Matific, Storyjumper, Plickers, Voki, Wordwall, MentalUP, Emaze, Canva, Quizizz, Powtoon, Storybird, Book Creator, Minecraft, Genially) are used in many teaching areas and age levels. The aforementioned tools are used in various ways in mathematics teaching by making use of their many features. In these applications and tools, ready-made applications can be used, as well as opportunities for the user to prepare it himself/herself in line with the needs. Thus, the user is a producer and can write books, install games, posters, etc., in line with the gain he wants, and can prepare materials to be used in the course, such as while preparing these materials, the user provides versatile development and learning. In order to enable students to acquire mathematics achievements in the form of games while having fun, a few digital tools are given below with examples of achievements in detail.

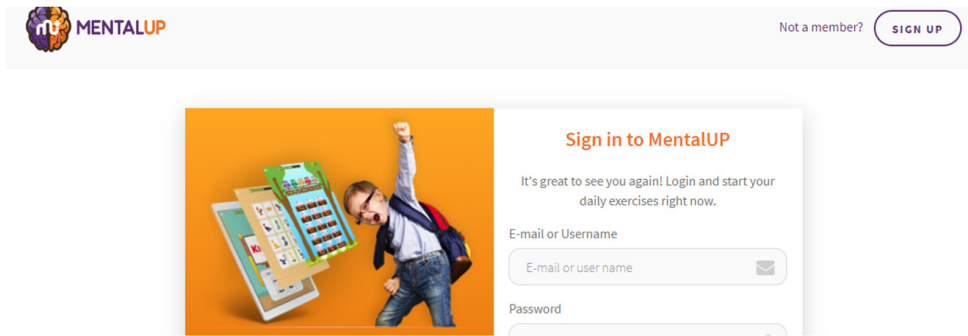


MENTALUP

It is defined as a gamified education platform and includes intelligence games. It is an application in Turkey. It is supported by the Scientific and Technological Research Council of Turkey [TUBITAK] and Yıldız Technical University. It supports the development of students' problem-solving skills, their analytical thinking, and the development of their numerical intelligence. The use of students between the ages of 4-13 is more intense and students of all ages can use it. The application can be

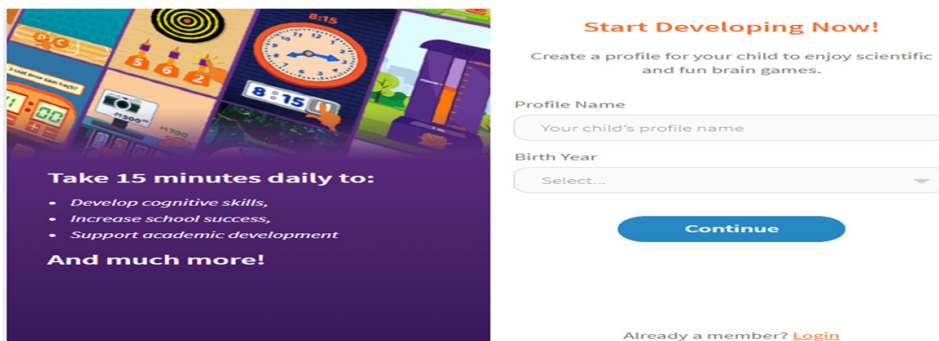
used comfortably on computers, phones and tablets. The app has more than 100 countries and more than 10 million users (*About MentalUP, 2021*). The application offers not only students but also physical and digital games that the student can play with all family members. In practice, the exercises are limited to 20 minutes per day to prevent students' screen addiction. It is necessary to become a member of the application at <https://www.mentalup.co/>. The registration screen is shown in Figure 6.

Figure 6: MentalUP Registration Screen



You can start to become a member by pressing the SIGN UP text in Figure 6. The next step, recording screen 2, is given in Figure 7.

Figure 7: MentalUP registration screen 2



You can proceed to the next stage by entering the name and date of birth of the student in Figure 7. A screen will appear to indicate the education level of the students. On this screen, it is necessary to indicate whether the student has arithmetic and counting skills related to the level of education he/she has, and whether he has reading skills according to the education level. A screenshot of this information is given in Figure 8. After the aforementioned stage, a screen will appear asking which skills the student would like to develop. The screenshot is given in Figure 9.

Figure 8: Identifying Student Mathematics and Reading Skills

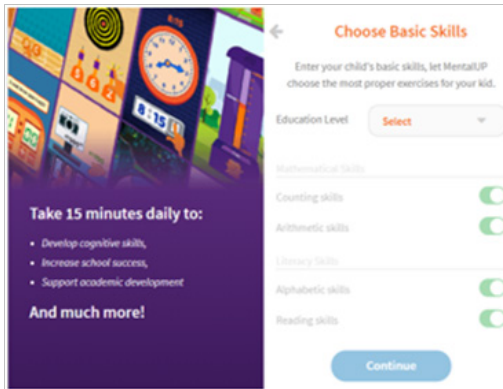
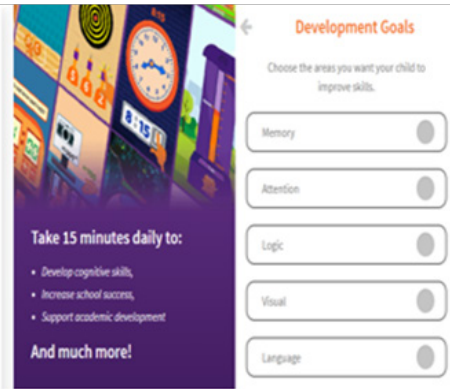


Figure 9: Selection of Targeted Skills in Students



As can be seen in Figure 8 and Figure 9, the application can be used after selecting the acquired basic skills and the skills to be developed. The application can be played in a limited number of math-related sample games at the grade level without registering. The screenshot in Figure 10 is taken from a sample game.

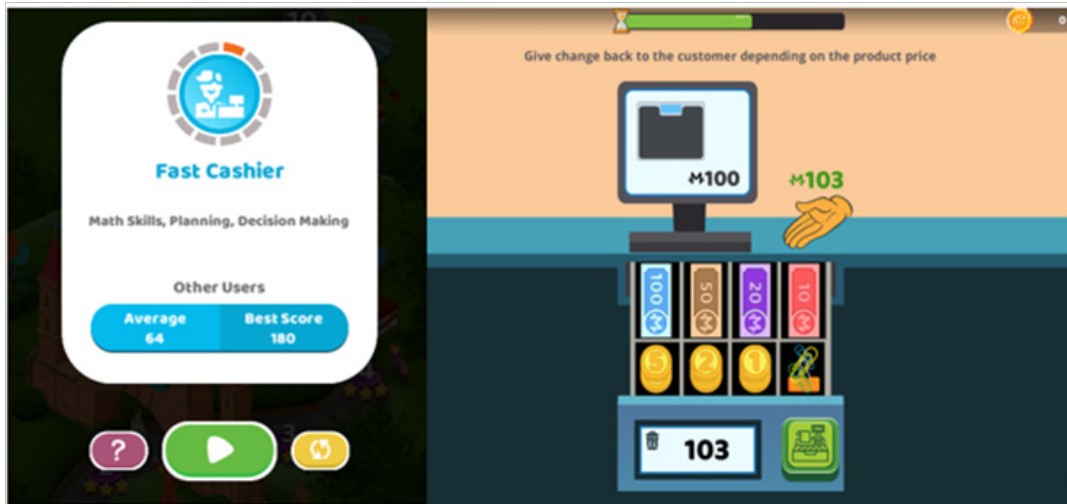
Figure 10: Game to Find the Executed Transaction (<https://www.mentalup.com/samples/game/game34/>)



The game in Figure 10 is a game designed to improve arithmetic skills. He asks the students at this level to find out which operation is used from the four mathematical operations (addition, subtraction, multiplication, division) by paying attention to the result and the numbers used, using operation symbols. It is a game that can be used in accordance with primary school mathematics lesson outcomes.

Below are screenshots of a few games that support the development of math skills in the application. Figure 11 shows the "Fast cashier game".

Figure 11: Fast Cashier Game



In the "Fast Cashier" game in Figure 11, a game was designed for students' mathematical skills, planning and decision making skills. It is to be able to quickly provide the amount specified in various ways, adhering to the price specified in the game. The student fulfills many math achievements in this game. Performing the mental addition process in line with the plan that the student will create in his mind, solving the numbers by taking into account (1 hundred + 3 ones), teaching the knowledge of step properties and equality (through the example: $103=100+1+1+1=50+50+2+1=50$) It is possible to obtain many gains such as $+20+20+10+2+1$. In Figure 12, the find 10 game is included.

Figure 12: Find 10 Game



The "Find 10" game in Figure 12 was created to improve students' planning and visual attention as well as their mathematical skills. In this game, the user is asked to determine two numbers that add up to 10 within the specified time. Again, in this game, as in the other game, students learn the knowledge of equality. Single-digit numbers up to 10, falling from top to bottom, are used. Thus, the student chooses two different or same numbers

whose sum are 10 from the numbers up to 10 and try to equalize them to 10, which is the same result (like $10 = 9+1=8+2=7+3=6+4=5+5$). With the balls falling randomly and changing during the selection, the student will also realize that the addition has the property of change. For example, a student who chooses 6 first and then 4 will realize that the result will not change by choosing 4 first and then 6 while the game continues. Or, a student with this achievement will have the opportunity to practice what they have learned.

MATIFIC



It is an application designed to contribute to students' meaningful learning of mathematical concepts, and to develop their critical thinking and algorithmic skills. Students can use it from computer and tablet. Internet is not mandatory as it has the feature of online and offline use. When the internet is used, the studies are updated in the application. It offers content suitable for the curricula of more than 50 countries and the application is used with the language of that country. It can also work integrated with the Google Classroom application (About Matific, 2021). Matific can be used by students, teachers, parents, school and school groups. Students can be given homework and their status can be easily followed by teachers. Graphics showing the performance differences between the use of Matific and the schools are available on the application's website. The application can be started with the “get started” button at the top of the page. The relevant screenshot is given in Figure 13.

Figure 13: Matific Start Screen (<https://www.matific.com/en/home/get-started/>)

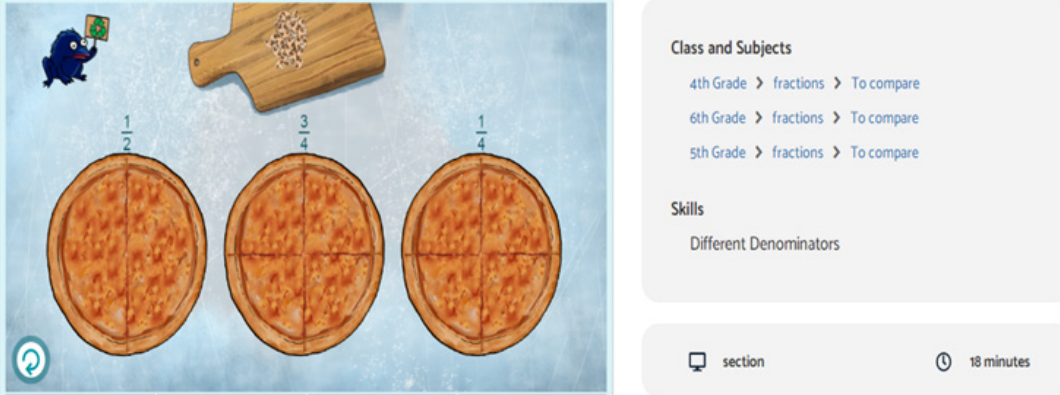


In Figure 13, when the button is pressed, the user is asked to select one of the appropriate teacher, student, parent or institution options. Below are a few game activities. In Figure 14, a game image related to the subject of fractions, which is at the 4th grade level in Turkey, is given.

Figure 14: Showing and Comparing Fractions

Showing and Comparing Fractions - Making Pizza

Focuses on Making Pizza, Representing and Comparing Fractions.



Class and Subjects

- 4th Grade > fractions > To compare
- 6th Grade > fractions > To compare
- 5th Grade > fractions > To compare

Skills

- Different Denominators

section 18 minutes

In the "Showing and Comparing Fractions" game in Figure 14, students are asked to show the specified fraction by adding materials and to rank the fractions according to their size and smallness characteristics. Thus, it is aimed for the student to realize the correct form of the fractions and the ordering of the fractions.

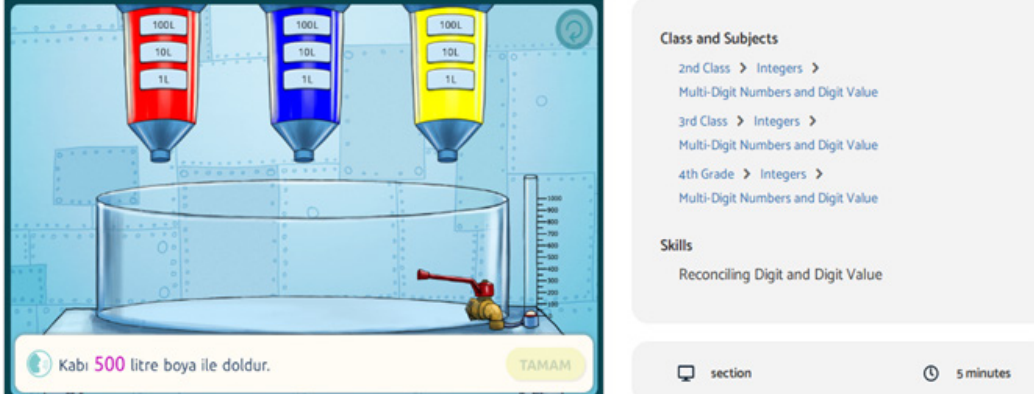


The "Showing and Comparing Fractions" game event can be accessed using the QR code on the side. In Figure 15, the game of flying colors is given.

Figure 15: Flying Colors

Creating Three Digit Numbers - Flying Colors

Flying Colors focuses on Generating Three Digit Numbers.



Class and Subjects

- 2nd Class > Integers > Multi-Digit Numbers and Digit Value
- 3rd Class > Integers > Multi-Digit Numbers and Digit Value
- 4th Grade > Integers > Multi-Digit Numbers and Digit Value

Skills

- Reconciling Digit and Digit Value

section 5 minutes

Kabı 500 litre boya ile doldur. TAMAM

In the "Flying Colors" game in Figure 15, the focus is on creating three-digit numbers. In the game, it is requested that the amount of paint is poured in the paint cubes and the pool is filled in this way. The student can reach the desired number in many different ways in this game. In order to reach a colorful result, the student may prefer to use a hundred units, sometimes using 10 units, or use 10 units when he/she can use one 10 units. This game will help student learn place values.



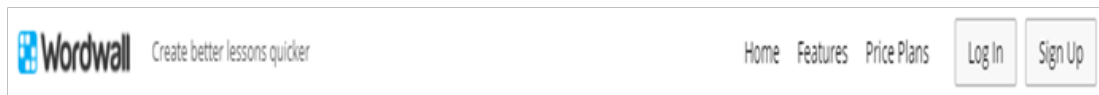
The "Flying Colors" game event can be accessed using the QR code on the left.

WORDWALL



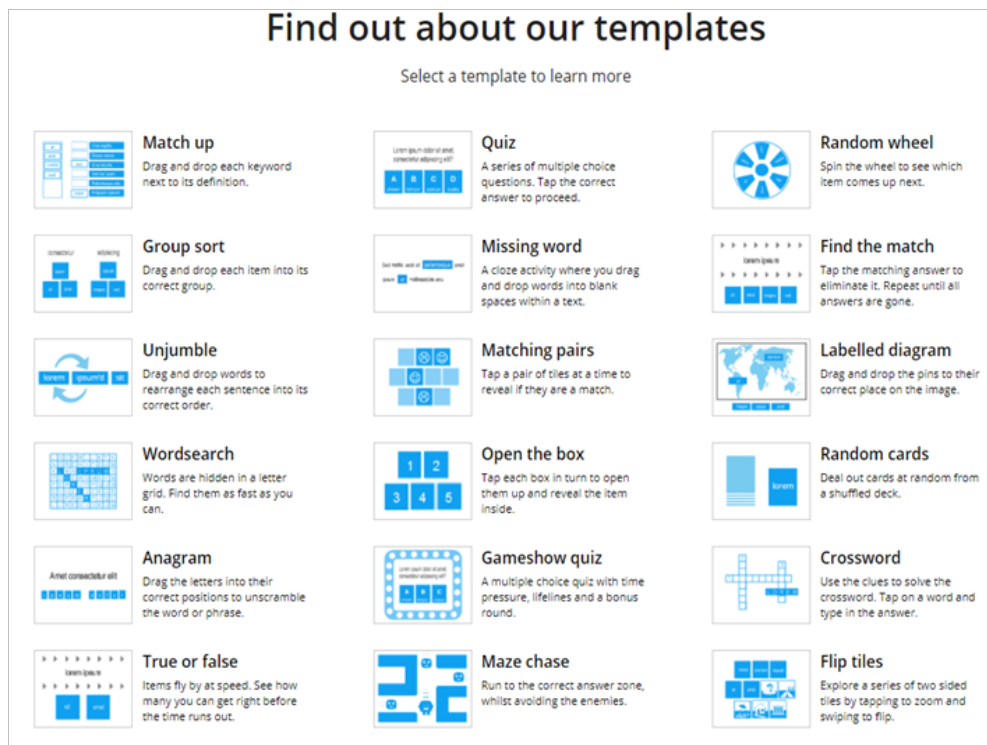
Tutorial is an application where fun gamified interactive activities can be found and created. It is very clear that it will contribute to the teaching, practice and learning of many lessons, including mathematics, by having fun. In this application, it is possible to benefit from previously made events, as well as the user himself can create new events. The user can easily access the pre-made applications from the communities tab and perform the event (Wordwall, 2021). In addition, if the user wants to create a new game event, he must be a member. Figure 16 shows the screenshot of the login session.

Figure 16: Login Screenshot (<https://wordwall.net/>)



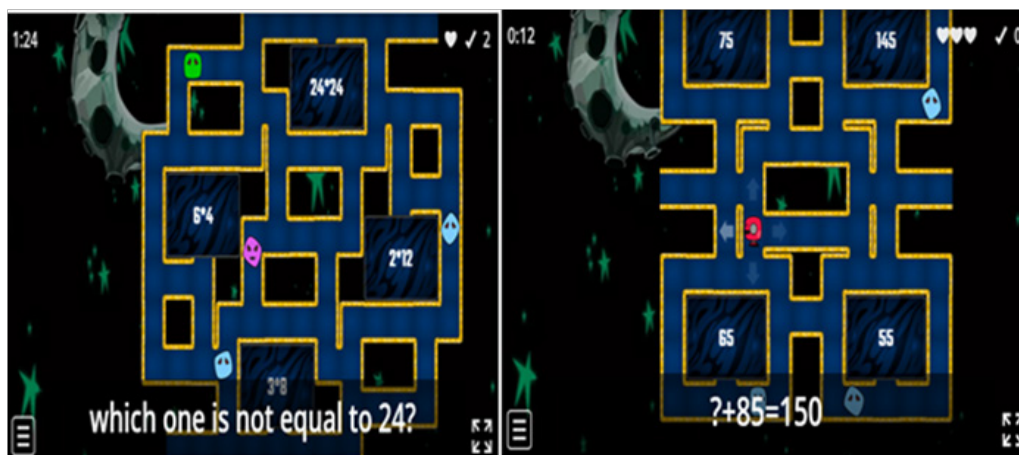
The user can log in to the application from the screen in Figure 16. For the user who wants to prepare the event himself, certain templates are included in the application that make it easier to prepare. Some of the templates included in the application are given in Figure 17.

Figure 17: Wordwall Event Templates (<https://wordwall.net/tr>)



From the templates given in Figure 17, the user can create the event by choosing what he/she wants. It has the opportunity to use this activity in an interactive or printable way. Teachers can share these activities with other teachers or give them as homework and evaluate the results. (Wordwall, 2021). A screenshot of an interactive activity with mathematical content called "Math Game" is shown in Figure 18.

Figure 18: An Interactive Game Example "Math Game" Screenshot



In the "Math Game" game in Figure 18, the process of finding and multiplying the sum (added + added = total) of primary school mathematics achievements is included. Thus, students are expected to make faster and more accurate decisions, taking into account

the time. The student who performs these operations will also have the acquisitions of mental operations. Along with this, although the student sees the plus (+) representing the addition sign, he will also be able to benefit from the subtraction by performing the reverse operation ($?+85=150$, $?=150-85=65$). Thus, it will perform not only addition but also subtraction.



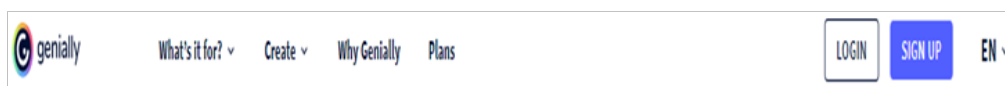
You can access the aforementioned “Math Game” game by using the QR code.

GENIALLY



The application provides training and easy use in some areas. Teachers or users can perform their own interactive activities or benefit from what is shared. From the templates offered in the tool, the user can use whatever he wants and associate it with the course he wants. With the Genially Web 2.0 tool, it is possible to create presentations, videos, graphics, interactive images, as well as create games (Genially, 2021). The activities can be shared by other teachers and students, if desired. The application can provide convenience in many lessons. There are ready-made templates designed to be used. However, the user must be logged in to create his own design. The relevant screenshot is given in Figure 19.

Figure 19: Registration Screenshot



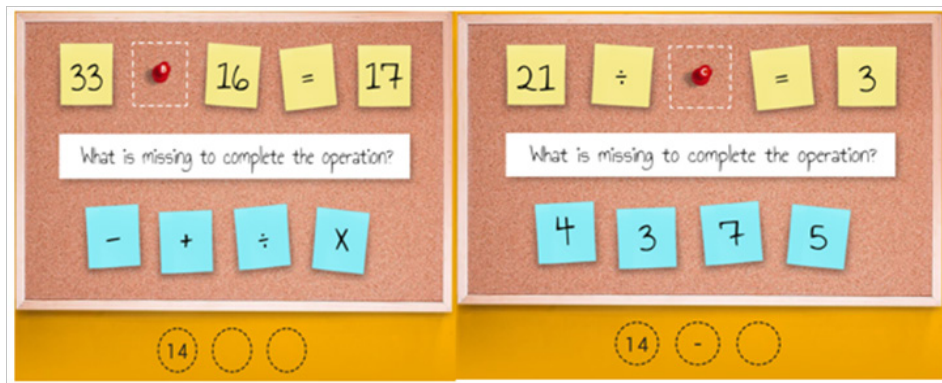
User registration can be created from the screen in Figure 19. After the user has created a record, they can start gamifying their work. A gamification template image is given in Figure 20, in which the tasks are ordered.

Figure 20: A Gamification Template With Quests Sequenced (<https://genial.ly/education/>)



In the template in Figure 20, various questions are asked in four tasks. At the end of each task, passwords are formed with the numbers given to the player by the game as well as the result of the operation. After all the tasks are completed, the passwords are entered and the game is concluded successfully. These questions may vary within the field preferred by the users. In the task game in Figure 20, it is aimed for the students to fulfill their four operational gains. In the first question, the missing factor from the multiplication process whose product was given is requested (multiplier*multiplier=product). Opportunities are given to the student to try various ways while performing the procedure. One of these ways is for the student to realize that the product can be reached by dividing by the given factor ($98 / 7 = 14$). Another way is to consider the numbers that will occur in the ones place of the numbers multiplied by 7 from the answers presented to the student ($7*21=...7$, $7*18=...6$, $7*16=...2$, $7*14=...8$, $7*19=...3$, $7*11=...7$). In this way, it is seen that the student not only takes the action, but also supports the ability to make faster decisions. Including the result of each question in a new question will enable the students to proceed carefully. The result of Figure 20 is used in Figure 21 and the next task is included.

Figure 21: Quest Game (<https://genial.ly/education/>)



In the task in Figure 21, the result of the operation was given and it was asked to find out what this operation was ($33?16=17$). After the subtraction symbol of the operation is determined, it is seen that this symbol is added in the next step. Likewise, while the missing number is requested in the division operation ($21/?=3$), at the end of the screen, it is seen that there is a problem about a subtraction operation to create a password using the results of the previous operation.



The QR code on the side can be used to reach the mission game.

In line with the results of the studies reached, some suggestions regarding the use of games in mathematics teaching are given.

SUGGESTIONS

The following suggestions can be offered to educators working in this field:

1. It has been proven that games are beneficial in teaching mathematics, and it may be right to focus on game-based teaching in mathematics teaching and many lessons.
2. In order for game-based teaching to be applied intensively in the curriculum, teacher characteristics and school conditions must be appropriate.
3. In order to carry out game-based education, informative seminars can be organized for teachers and certain physical and digital games can be taught.
4. Game activities suitable for all primary school mathematics subjects can be created.
5. During game-based teaching, setting the environment and performing the game in accordance with a plan can make it easier for the game to reach its goal.
6. Paying attention to the time in the use of digital games, while students are trying to benefit from technology, computer addiction and so on. It can contribute to controlling the negative aspects of technology.

REFERENCES

- About Matific. (2021). <https://www.matific.com/tr/tr/home/our-product/technical-requirements/>
- About Mentalup. (2021). <https://www.mentalup.co/about-us>
- Abrams, S. S. (2009). A gaming frame of mind: Digital contexts and academic implications. *Educational Media International*, 46, 335-347. <https://doi.org/10.1080/09523980903387480>
- Ailwood, J. (2010). Playing with some tensions; poststructuralism, Foucault and early childhood education. In L. Broker and S. Edwards (Eds.), *Engaging play* (pp. 210-222). Open University.
- Anita, E. (2006). Scripted curriculum: Is it a prescription for success. *Childhood Education*, 83(1), 29-32.
- Burguillo, J. (2010). Using game theory and competition-based learning to stimulate student motivation and performance. *Computers & Education*, 55, 566-575. DOI: <https://doi.org/10.1016/j.compedu.2010.02.018>
- Genially. (2021). Erişim adresi: <https://genial.ly/why-genially/>
- Güneş, G. (2010). Teachers' views on the use of games and activities in teaching mathematics at second level of primary education (Unpublished master's thesis). Kafkas University Social Sciences Institute, Kars.
- Hoşgör, A. (2010). First grade primary school teacher's opinion about using game activities in mathematic courses. (Unpublished master's thesis). Çukurova University Social Sciences Institute, Adana.
- Hutchings, C. H. (2012). Applications of game theory in education (Unpublished master's thesis). Sierra Nevada College, Nevada.
- Pehlivan, H. (2016). The role of play on development and learning. *Journal of Human Sciences*, 13(2), 3280-3292. DOI: <https://doi.org/10.14687/jhs.v13i2.3767>
- Sanford, K., & Madill, L. (2007). Understanding the power of new literacies through video game play and design. *Canadian Journal of Education*. Ottawa: Canadian Society for the Study of Education. 30(2), 432-455.
- Sarpkaya, G., Arık, G. & Kaplan, H. A. (2011). The relationship between elementary mathematics teacher candidates' awareness of using the metacognitive strategies and their attitudes towards mathematics. *The Journal of Social Sciences Research*, 6(2), 107-122.
- Tabuk, M. (2019). A meta-analysis on the relationship between attitude toward mathematics

and mathematics achievement. Marmara University Atatürk Education Faculty Journal of Educational Sciences, 49(49), 167-186. DOI: <https://doi.org/10.15285/maruaebd.358096>

Toptaş, V., Elkatmış, M., & Karaca, T. (2012). Analysis of 4. grade mathematics curriculum learning areas and mental areas in mathematics student workbook questions according to TIMSS. Ahi Evran University Journal of Kırşehir Education Faculty, 13(1), 17-29.

Tuğrul, B. (2015). Oyunun gücü. Aksoy, A. ve B. Aksoy (Ed.). Okul öncesi eğitimde oyun içinde. Hedef.

Ursini, S. & Sánchez, G. (2008). Gender, technology and attitude towards mathematics: a comparative longitudinal study with Mexican students. ZDM, 40(4), 559-577. Erişim adresi: <http://dx.doi.org/10.1007/s11858-008-0120-1>

Uskan, S. B., & Bozkuş, T. (2019). Place of play in education. International Journal of Contemporary Educational Studies (IntJCES), 5(2), 123-131.

Wordwall. (2021). Erişim adresi: <https://wordwall.net/tr/features>

Yenilmez, K. (2007). Attitudes of primary school students toward mathematics. Ondokuz Mayıs University Education of Journal, 23, 51-59.

To Cite This Chapter:

Büyükkarıcı, A. (2021). The place of game in primary school mathematics teaching and digital game tools. In Ö. Akman, F. O. Atasoy, & T. Gür, (Eds.), Education, social, health and political developments in Turkey between 2000-2020, 62-82. ISRES Publishing.