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Research Article

Classroom Teachers' Opinions on Game-Based Assessment in Mathematics Lesson: A Phenomenological Research*

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Abstract - The study aims to gather the opinions of classroom teachers about the reflections of game-based assessment in mathematics lessons in primary school. The study followed a phenomenological design, which is one of the qualitative research methods. The participants consisted of eight classroom teachers working in public schools in Edirne and Kırklareli provinces in the 2023-2024 academic year. Participants were selected using convenience sampling, a type of purposive sampling method. The study data were collected using a semi-structured interview with six questions. The data were analyzed using content analysis. Based on the findings, game-based assessment was seen as a positive development. For teachers, it allowed long-term observation and monitoring of gains that turned into behaviors. For students, it fostered learning through fun, a desire to win, active participation, competition experience, and reduced exam stress. It also contributed to more enjoyable lessons and helped reduce negative perceptions of the subject. For teachers, challenges included the inability to make unbiased evaluations and low reliability. For students, negative aspects included lack of attention, focusing too much on fun, not following the rules of the game, and ignoring instructions. In terms of the mathematics lesson itself, issues included falling behind on the material and difficulty in creating games suitable for each learning objective. To address the challenges faced during game-based assessment in mathematics lessons, several strategies were suggested, including defining clear evaluation criteria, fostering cooperation and active participation, aligning objectives, following instructions, preparing a guideline, and ensuring material completion.

Keywords: Game-based assessment, primary school mathematics lesson, teacher views, phenomenology.

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Introduction

Assessment and evaluation processes are critical to ensure mathematics teaching success and improve students' learning processes. These processes are vital in determining how much knowledge students acquire, which skills they develop, and in which areas they need support (Birgin & Gürbüz, 2008; Kutlu et al., 2010). Effective assessment and evaluation in education requires a systematic approach to accurately determine student performance and develop teaching strategies (Karasar, 2005). These processes generally include observation and evaluation stages. Comparisons made according to the criteria determined after observation using specific tools are necessary to evaluate the student's development and the effectiveness of the educational process (Turgut & Baykul, 2019).

Modernizing education and training processes has brought student-centered and innovative approaches. In this context, new approaches that observe the student's development at every stage and care about the process have been adopted by moving away from traditional evaluation methods (Acat & Uzunkol, 2010). These reforms in education systems have made assessment processes more dynamic and student-oriented (Pellegrino et al., 2001). This transformation includes increasing teachers' assessment competencies and improving students' academic achievement (Looney, 2009).

Assessment and evaluation processes guide teachers by determining students' knowledge and skill levels (Black & Wiliam, 1998). Therefore, appropriate methods that vary according to the course, subject, and outcome should be selected for assessment. In traditional assessments, students are evaluated with a single exam after a long period of education and teaching, disregarding their status. However, efforts have been made to change this, and the student's performance during the learning process has become significant. In contrast to the evaluation that emphasizes only paper and pencil when it comes to measurement and evaluation, new and various evaluations are made in which the student himself/herself, his/her interests, and abilities come to the forefront (Gelbal & Kelecioğlu, 2007). While one of these assessment methods, diagnostic assessment, shows in which areas students need help, formative assessment provides instant feedback during the learning process and enables updating teaching strategies (Shepard, 2000). Outcome-oriented assessment measures students' overall performance (Harlen, 2007). Studies conducted in Türkiye and internationally show that formative assessment increases student achievement (Black & Wiliam, 1998; Kutlu et al., 2010). International programs such as PISA and TIMSS use these assessments to compare education systems (Organisation for

Economic Cooperation and Development [OECD], 2019). In addition, Arnold (2011) emphasizes that formative assessment significantly contributes to student achievement when it is a feedback-based process.

In Türkiye, the Ministry of National Education (MoNE, 2023) has made various regulations to adapt to changes in assessment and evaluation processes. The regulation published in 2023 emphasized that students' academic and social development in grades 1, 2, 3, and 4 should be continuously monitored. For this purpose, it was requested that students be evaluated through game-based assessments and observation forms for participation in individual and group activities (MoNE, 2023). It also encouraged the adoption of process-oriented approaches in evaluating in-school work (MoNE, 2024a). In parallel with these developments, in the 2024 primary school mathematics curriculum, students are expected to be able to transform their skills into actions when necessary. For this purpose, supportive studies should be conducted to develop dispositions, which can be expressed as the predispositions needed to transform skills into actions. As mental patterns can be learned and developed, dispositions (curiosity, independence, empathy, assertiveness, playfulness, focus, original thinking, etc.) are triggering in exhibiting skills. The tendency of playfulness also comes to the fore as making learning a subject or behavior fun and enjoyable. In the curriculum, it is vital to create learning environments that will enable the emergence and support of dispositions and include learning experiences that offer the opportunity to observe dispositions concretely (MoNE, 2024a). Therefore, game-based assessments are necessary for providing concrete and enjoyable experiences to support the tendency of playfulness foreseen by the curriculum.

Game-based assessment is an essential innovation in education. While traditional assessment methods usually measure students' knowledge and skills with a single exam, game-based assessment can offer various advantages to students. Learning through games aims to increase the student's interest in the lesson, increase motivation, and make learning fun (Offenholley, 2012; Tayfur, 2019). Therefore, using games to assess mathematical skills may potentially provide realistic feedback to students, as it will contribute to a more fun and active assessment process.

Games support learning processes and provide opportunities to reduce students' anxiety about the lesson, relax, and have fun (Çil & Sefer, 2021; Offenholley, 2012; Tayfur, 2019). In these ways, games can effectively solve the perception of mathematics lessons as boring and intimidating. International literature emphasizes that game-based learning and

assessment practices positively affect students' learning experiences (Gee, 2003; Papert, 1993). In particular, the potential of games to increase student motivation and make learning processes more effective is widely recognized. Game-based assessments in mathematics courses can reveal this potential, make students participate more in the lesson, and make learning processes more effective. Such assessment methods can help students experience mathematical concepts more concretely and reduce their prejudices against mathematics. Linking games to mathematics in this way, rather than seeing them as the opposite of work or leisure activity, will lead to greater student engagement and success (Offenholley, 2012).

Recently, it has been decided to abolish exams at the primary school level and replace them with game-based assessment in Türkiye (MoNE, 2023). This points to a new approach at the primary school level, unlike the preschool period. In this context, questions like “How can game-based assessment be applied in elementary school mathematics lessons?” “What form should such assessments take?” and “What are the difficulties encountered in practice?” constitute the rationale for this study. However, there have been many studies using play as an assessment tool at the international level (Chiu & Hsieh, 2017; Gomez et al., 2023; Kiili & Ketamo, 2018; Leong & Toh, 2021; Skillen et al., 2023) at the national level, it is seen that studies on game-based assessment have been conducted mainly at the preschool level (Çelik & Demirbaş, 2023; Işıkoğlu Erdoğan & Canbeldek, 2017; Okatan & Tagay, 2021). Therefore, this study, which was conducted to determine how game-based assessment can be an effective tool in mathematics teaching at the primary school level and how these practices can be improved, is considered necessary to provide essential findings for teachers and policymakers.

In the literature, it is known that many studies have been conducted on using games in education, and their effects have been examined using different variables. When these studies are examined, it is seen that games can be used as an assessment tool (Okatan & Tagay, 2021) and in value transfer (Gündüz et al., 2017), effective in the treatment of developmental and psychological disorders (Genç & Çakmak Tolan, 2021); and effective in variables such as problem-solving (Pintér, 2010; Şahin, 2019), concentration (Gözüm & Kandır, 2020), motivation (Yazıcıoğlu & Çavuş-Güngören, 2019), retention (Demir, 2016), attitude (Şanlıdağ & Aykaç, 2021), achievement (Dönmez et al., 2021; Ergül & Doğan, 2022). In addition, game-based activities have positive contributions such as fun, concretization, active participation, social interaction, time-saving, student motivation, permanent learning, attracting attention and instant feedback (Çil & Sefer, 2021; Demir,

2016; Gür & Kobak Demir, 2016; Katmada et al., 2014); it was evaluated that they would have positive effects on breaking the prejudice against mathematics lessons and increasing interest in the course (Demir, 2016; Özata & Coşkuntuncel, 2019). It has also been determined that the use of games in mathematics lessons has limitations such as not being suitable for crowded classes, not being applied due to lack of materials and environment in schools, taking too much time, and making classroom management difficult (Çil & Sefer, 2021; Ergül & Erşen, 2023; Gür & Kobak Demir, 2016; Özata & Coşkuntuncel, 2019).

In 2023, the Ministry of National Education amended the measurement and evaluation regulation: "In primary schools, the success of students is monitored by taking into account their developmental levels, their participation in teacher-guided lesson activities, observation forms for participation in individual and group activities, game-based assessments and measurement tools for fulfilling the assigned tasks. It is shown on the report card as "very good," "good," "sufficient," and "should be improved." (MoNE, 2023). Therefore, starting from the 2023-2024 academic year, the evaluation of students with game-based tools and the formation of report card opinions (very good, good, sufficient, should be improved) according to these results have brought up the issue of how the game will be used as an evaluation tool in mathematics lessons and what its effects will be. In this context, the purpose of this study is to obtain the opinions of classroom teachers about the reflections of game-based assessment in mathematics lessons in primary school, a recent change in the education system. The research questions were formulated as follows:

1. What are the opinions of classroom teachers about game-based assessment in mathematics lessons?

2. What are the opinions of classroom teachers about the difficulties encountered during game-based assessment in mathematics lessons?

3. What are the suggestions of classroom teachers for game-based assessment in mathematics lessons?

Method

Research Design

This study, in which teachers' views on game-based assessment in mathematics lessons were taken, was structured according to the phenomenological design, one of the qualitative research designs. Qualitative research involves a qualitative process in which qualitative data collection methods such as observation, interview, and document analysis

are carried out and examine events and phenomena in their reality (Yıldırım & Şimşek, 2021, p. 37). In phenomenology, which is based on personal experiences, a phenomenon is identified, and people's experiences, perceptions, and the meanings they attribute to this phenomenon are tried to be understood (Baş & Akturan 2017, p. 87). In other words, phenomenology investigates how people experience an existing situation, what meaning they attribute to it, and how it appears in its nature (Patton, 2018, p. 104). This study considered that the teachers participating in the research had experience with play-based assessment. Interviews were conducted with teachers working in public schools in the second semester of the academic year to obtain their opinions on this new practice. In addition, by conducting interviews with teachers working at different grade levels, the experiences and opinions of these teachers on game-based assessment for all grade levels at the primary school level were analyzed, and it was tried to reveal how they attributed meaning to the determined phenomenon.

Participants

The study participants comprised eight classroom teachers working in public schools in Edirne and Kırklareli provinces in the 2023-2024 academic year. The fact that one of the study's authors is a classroom teacher played a significant role in identifying and selecting the participant teachers. As a result of the author's conducting a series of interviews in his school and at the point of identifying teachers with experience in this practice, the research was carried out by identifying teachers who had experience in game-based assessment and who volunteered to participate in the study. Again, care was taken to ensure that teachers worked at all grade levels in determining the teachers participating in the study. There was also one teacher with whom a pilot interview was conducted before teacher selection. As a result of the interview with this teacher, it was evaluated that it was essential to include 4th-grade teachers in the study, and three 4th-grade teachers were included in the study. The reason why 4th-grade teachers were specifically selected is that written exams will no longer be used to evaluate students in the interview's academic year. For these reasons, the convenience sampling method, one of the purposeful sampling methods, was used to determine the study participants. The convenience sampling method, preferred for speeding up the research and being practical, generally includes the immediate environment the researcher can easily reach. Therefore, it is a way that saves time for the researcher (Yıldırım & Şimşek, 2021, p. 121). The reason for choosing this method is that one of the authors of this study is a teacher. The study included teachers whom the researcher knew in

the school where the researcher worked and in her immediate surroundings and who volunteered to participate in the study. Information about the participants is presented in Table 1.

Table 1 Characteristics of Participants

Teacher	Gender	Education level	Experience	Occupational title	Age	Class of service
T1	Male	Master's degree	7	Teacher	33	4th grade
T2	Female	Master's degree	10	Expert teacher	38	4th grade
T3	Female	Master's degree	8	Expert teacher	34	2nd grade
T4	Female	Bachelor's degree	7	Teacher	32	3rd grade
T5	Female	Bachelor's degree	16	Expert teacher	43	3rd grade
T6	Female	Bachelor's degree	10	Expert teacher	36	1st grade
T7	Male	Bachelor's degree	8	Teacher	34	4th grade
T8	Female	Bachelor's degree	8	Teacher	34	2nd grade

Table 1 shows two male and six female teachers participating in the study. Three of the teachers have master's degrees, and five have bachelor's degrees. The teachers' professional experience ranged between 7 and 16 years; four of them were expert teachers, and four were teachers. Their ages ranged between 32 and 43. One of the teachers is a first-grade teacher, two are second-grade teachers, two are third-grade teachers, and three are fourth-grade teachers. In addition, the teachers who participated in the interview were coded as T1 and T2, and these codes were used in the quotations. For example, T1 represents the number one teacher interviewed.

Data Collection

The study data were collected using a semi-structured interview with six questions. As in this study, if the reflection of an issue on people, their thoughts and feelings on that issue are tried to be determined, the most accurate answer will be given by those people. For this reason, a semi-structured interview form was used to obtain answers to open-ended questions in a natural and free environment (Türnüklü, 2000).

Both expert opinions were taken when preparing the interview form, and a pilot interview was conducted. For this purpose, a 10-question draft form covering the research problems was prepared first. This form was submitted to the opinion of an expert in mathematics education, and two questions that needed to be more suitable for the research were removed. Then, eight questions in this draft form were applied by conducting a pilot interview with a 4th-grade classroom teacher. During the interview, it was seen that two questions could be evaluated within the other six questions. In addition, it was decided that it would be appropriate for the teachers to be aware of the changes made in the Ministry of

National Education's measurement and evaluation regulation and to add personal information (gender, education level, experience, professional title, age, and grade) to the interview form. Sample questions in the interview form are: What are your thoughts about using game-based assessment in your mathematics lessons? What are the advantages of using game-based assessment in your mathematics lessons? What difficulties do you encounter while implementing game-based assessment activities in your mathematics lessons? What are your opinions on how game-based assessment can be done more qualitatively in your mathematics lessons?

After the interview form was prepared, appointments were made to conduct interviews with teachers who volunteered to participate in the study. Interviews were conducted by meeting at the interview place on the day and time of the appointment. Before starting the interview, the teachers were informed about the purpose of the research, that the answers they shared would not be shared with anyone, and that their names would be kept confidential. They were also informed that the interview would be recorded with a voice recorder, and the interviews began. The interviews lasted approximately 30 minutes. Short notes were taken during the interviews to serve as a reference for the researchers.

Data Analysis

In this study, the data were analyzed using the content analysis method, codes were extracted, and categories were created. When conducting content analysis, criteria should be determined depending on the research question, and the data should be compared internally or with an external criterion. The raw data obtained here should be systematically transformed into categories (Öğülmüş, 2019). Content analysis provides a closer approach to the numerical and more apparent dimension in quantitative research, one of the most obvious differences between quantitative and qualitative research. In other words, it helps to understand and explain the emerging themes and patterns when analyzing qualitative data. Qualitative content analysis consists of four steps: coding data, finding themes, organizing codes and themes, and describing and interpreting findings (Yıldırım & Şimşek, 2021, p. 240).

In the first step of this analysis, the second author initially identified 57 codes from the interview data, and together with the first author, they reduced this number of codes to 54. They also divided the codes into positive and negative expressions. In the second stage, categories were created by considering the sub-problems. Out of 54 codes, 26 codes determined for the first sub-problem were categorized in terms of teacher, student, and

course by considering positive and negative expressions. The 14 codes determined for the second sub-problem were divided into subcategories, such as before, during, and after the implementation of this assessment, which is a new practice. For the third sub-problem, 14 codes were categorized into three subcategories: teachers, students, and course. The researchers placed the codes into the categories independently and then came together. The 7 codes identified for the first sub-problem, such as “lack of materials,” “lack of information,” and “lack of time,” were included in the other sub-problems. For the second sub-problem, it was decided to change the code “games do not include the learning outcomes” to the code “games cannot be prepared for each learning outcome.” It was decided that it would be appropriate to add the codes “application in the form of competition” and “combining learning outcomes” to the 14 codes determined for the third sub-problem. In addition, it was decided that it would be more appropriate to change the name of the subcategory of suggestions for the “lesson” in this category to “other.” In this way, the number of codes, initially determined as 57, decreased to 48 after the authors came together and made evaluations and the procedures in the analysis process were completed. After completing these procedures, the findings were presented with direct quotations from the teachers' opinions that were thought to explain the codes and categories in the best way. In the presentation of the findings of the codes and categories, the frequency values of the teachers' opinions for each code were included.

Validity and Reliability

The most important criterion for ensuring validity and reliability in research is to reach the same objective results and observe similar situations no matter how many people examine the research. In addition, the most crucial criterion in validity is that the measurement tool focuses on what it aims to measure and measures it in the best way. Reliability is a prerequisite for validity; however, it is not sufficient on its own (Öğülmüş, 2019). Unlike quantitative research on validity and reliability, qualitative research may be skeptical because it is not based on numerical values. However, more methods used in measurement increase validity and reliability. Among these methods, credibility (internal validity), transferability (external validity), consistency (internal reliability), and confirmability (external reliability) are methods to increase validity and reliability (Creswell, 2013).

In order to ensure credibility in the research, participant characteristics were presented in detail by making detailed descriptions from participant views. The researchers decided to

transfer the participants' views into codes and categories. In order to ensure transferability, participants' views were analyzed individually and independently of each other and grouped under standard codes. Direct quotations from the participants' views that best explained each code were included. In order to ensure consistency, expert opinions and supervision were frequently obtained during the interviews with the teachers participating in the interviews. In addition, consistency was checked by constantly comparing the findings and interpretations with each other. Throughout the research, the expert suggestions were taken into consideration. In order to ensure confirmability, the researchers tried to reflect on how the teachers approached the phenomenon of game-based assessment with an objective approach. In order to control objectivity, the interview data obtained from the participants were recorded in writing.

Results

Classroom Teachers' Opinions on Game-Based Assessment

Regarding the first sub-problem of the study, the positive and negative opinions of classroom teachers on the use of game-based assessment in mathematics lessons were determined in three categories: teacher, student, and course.

The data on the positive and negative aspects of game-based assessment for teachers are presented in Table 2.

Table 2 Positive and Negative Aspects of Game-Based Assessment for Teachers

Category	Subcategory	Code	f
From the Teacher's Perspective	Positive aspects	Long-term observation	5
		Seeing the acquisition that turns into behavior	7
	Negative aspects	Inability to make an objective assessment	8
		Low reliability of the assessment	8

When Table 2 is examined, in the subcategory of positive aspects, five teachers expressed the code of game-based assessment in mathematics lessons providing the opportunity to make long-term observations, and seven teachers expressed the code of providing the opportunity to see the acquisition that turns into behavior. Teacher opinions in this subcategory are exemplified below.

T5: In the old system, when we did exams, we evaluated a long process in a short time; that is, with an exam, this was insufficient, in my opinion, but when we play

games, we evaluate children in a process again, which allows us to observe them during the game.

T7: When they play games, I don't just say this to evaluate them; I sit and watch the children. I have an idea about their behavior. Thanks to the game, I had the opportunity to see how acquisition turns into behavior in children.

In the negative aspects subcategory, the answers given by eight teachers formed the codes that made it difficult to make an objective evaluation and low the reliability of the evaluation. Some of the negative opinions are exemplified below.

T1: Equal conditions and standard criteria are required for an unbiased evaluation, and it is tough to provide them. Because game assessment is open to all kinds of interpretations.

T2: Since we have yet to get an evaluation scale, everyone makes their own judgments.

This situation creates confusion and causes unfairness.

Data on the positive and negative aspects of game-based assessment for students are presented in Table 3.

Table 3 Positive and Negative Aspects of Game-Based Assessment for Students

Category	Subcategory	Code	f
From the student's perspective	Positive aspects	Learning with fun	8
		Willingness to win	3
		Active participation	7
		Gaining competition experience	7
		Reducing exam stress	5
	Negative aspects	Lack of attention and interest	3
		Focus on having fun	7
		Failure to comply with game rules	4
		Inability to follow instructions	6
		Exclusion by peers	5
		Inability to adapt to group games	6

When Table 3 is analyzed, in the positive aspects subcategory, eight teachers expressed the code of learning by having fun, three teachers expressed the code of desire to win, seven teachers expressed the code of active participation, seven teachers expressed the code of gaining competition experience, and five teachers expressed the code of reducing exam stress. Teacher views on this subcategory are exemplified below.

T2: Even the word "game" brings joy to children in the classroom. At least my class is like this. Children have fun and learn. Math lessons are fun.

T5: I already try to use competition in my class, especially with hardworking children. It makes them want to win even more.

T3: When playing games, even if the student is sick, he/she eventually becomes involved in the game, which is very nice.

T1: If a competitive environment can be established in the classroom, the lessons will always be more fun and faster in my teaching life. Children get excited when they feel the spirit of competition.

T8: I think stress and fear will decrease in my class if I even try to say, "No more exams; we will play games."

In the negative aspects subcategory, the code for lack of attention and interest was formed by three teachers, the code for focusing on having fun was formed by seven teachers, the code for not following the game rules was formed by four teachers, the code for not following the instructions was formed by six teachers, the code for being excluded by peers was formed by five teachers, and six teachers formed the code for not adapting to group games. Some of the negative opinions are exemplified below.

T2: Attention deficit affects the evaluation result if students act with the game's logic and focus only on having fun.

T7: Since the first thing that comes to children's minds when they think of games is to have fun, just like we do, there is a possibility that they focus on having fun and getting away from the learning environment.

T1: Just like the evaluation criteria are not common, a healthy evaluation can only be made when the rules of the games are followed. If a student gets a low score because of such a game, it may cause injustice.

T2: Students may have difficulty following instructions due to a lack of interest.

T3: In case of any exclusion by the group, the child may not be able to reflect this even in a subject he/she knows and may get a low grade. In other words, the group will have a negative effect on the evaluation of this child.

T4: There will necessarily be games to be played with the group rather than individually, and the group is an entirely different issue. Not every child can adapt.

Table 4 presents the data on the positive and negative aspects of game-based assessment regarding mathematics lessons.

Table 4 Positive and Negative Aspects of Game-Based Assessment for Mathematics Lesson

Category	Subcategory	Code	f
In terms of mathematics lesson	Positive aspects	Conducting fun lessons	8
		Breaking the prejudice against the course	6
	Negative aspects	Failure to keep up with the subjects	8
		Failure to prepare appropriate games for each achievement	8

When Table 4 is analyzed, in the subcategory of positive aspects, eight teachers expressed the code for the lessons being fun, and six teachers expressed the code for breaking the prejudice against the course. Teacher views on this subcategory subcategory are exemplified below.

T4: Exam anxiety is a reality, and it affects even us. The effect of games on children is indisputable. Using the game at every stage means more fun lessons in the simplest form.

T7: Whenever we play games in math class, they do not want the lesson to end. In this way, even they want to do math. I think this shows that the game reduces prejudice.

In the negative aspects subcategory, the answers given by eight teachers formed the codes of not keeping up with the subjects and not preparing games suitable for each outcome. Some of the negative opinions are exemplified below.

T1: Since the game will take more time than normal written assessments and time must be allocated for each student individually when evaluating each student with the game, I think I will have problems keeping up with the subjects.

T3: Some of the objectives will be ignored because no matter how many games there are, I don't think there can be a game that will fit every objective in every lesson at every grade level.

Difficulties Encountered While Conducting Game-Based Assessment

Regarding the second subproblem of the study, the difficulties encountered by classroom teachers while conducting game-based assessments in mathematics lessons were grouped under three subcategories: before, during, and after the implementation.

Table 5 Difficulties Encountered During Game-Based Assessment in Mathematics Lessons

Category	Subcategory	Code	f
Difficulties encountered	Before the application	Lack of knowledge	7
		Lack of an application guide	8
		Failure to prepare appropriate games for each achievement	6
		Lack of knowledge of evaluation criteria	8
	During the application	Lack of time	4
		Lack of materials	4
		The game does not match the level of the student	3
		Fast lesson processing	5
		Textbooks do not support game-based assessment	7
	After the application	Failure to evaluate personal success	5
		Gains that cannot be assessed	7
		Differences in scoring	4
		Assessment not aligned with achievement	4

When Table 5 is examined, among the codes before the application subcategory, the code for lack of information was formed with the opinions of seven teachers, the code for lack of an application guide was formed with the opinions of eight teachers, the code for not being able to prepare a game suitable for each outcome was formed based on the opinions of six teachers, and the code for not knowing the evaluation criteria was formed with the opinions of eight teachers. Some of the related teacher opinions are as follows.

> *T4: Honestly, I learned about this innovation thanks to this interview. I had not received any information about implementing it at school or in any other way before.*

> *T5: We are expected to produce games that include all the outcomes, but if each teacher tries to produce and implement easy and difficult games, there will be confusion and a waste of time. In other words, the biggest need right now is a rich guide full of games that include the learning outcomes for all of us.*

> *T6: Evaluating each outcome or topic with games requires a long time. However, one day was enough for exams. I think it has become very difficult to complete the subjects or to complete the assessment in its entirety.*

T8: Games are something that both students and teachers facilitate, but if we are going to evaluate and grade a student according to games, there should be specific criteria. Otherwise, it is a vast spectrum. This issue is inextricable for me.

Among the codes in the subcategory during the application, the code for the shortage of time and materials was formed with the opinions of four teachers, the code for the fact that not every game appeals to the level of every student was formed with the opinions of three teachers, the code for fast lesson processing in order to apply the games was formed with the opinions of five teachers and the code for the fact that textbooks do not support game-based assessment was formed with the opinions of seven teachers. Some of the related teacher opinions are as follows.

T1: In the past, allocating one class hour for exams while grading was enough, but now it takes a lot of time even to play a game. We had a lot of trouble with this.

T5: Games set up in a more material-rich environment will appeal to more senses, but the evaluation will not be qualified without material.

T4: Every game may only work for some students. While hardworking students may get bored in a game with straightforward content, we may not be able to evaluate low-level students in challenging games.

T8: I tried to teach the lesson faster by arguing that games should be designed and applied to include each outcome, but I cannot say that it was very productive.

T1: I find the number of games in the textbooks insufficient. Games are at the center of primary school children's lives. Therefore, more games should be included in the books.

Among the codes in the “after the application” subcategory, the code for the inability to evaluate personal achievement was formed with the opinions of five teachers, the code for the gains that could not be evaluated was formed with the opinions of seven teachers, and the codes for the differences in scoring and the incompatibility of the evaluation with the achievement were formed with the opinions of four teachers. Some of the related teacher opinions are as follows.

T1: Evaluating students during a game becomes difficult. We also set up games that emphasize a single person's performance, but inevitably, there are also group games, and here, I had to give points to the group.

T5: I had the most difficulty designing games to evaluate all the outcomes. There were some outcomes that I could not fully evaluate. There was inevitably a deficiency.

T2: I think I prepared the games with a little difficulty. But this was not so challenging for every student; some got high scores from easy games. We need common evaluation criteria and games for all of us. Otherwise, there will be scoring differences between teachers.

T8: I have some children who are very active and successful in class but cannot show themselves in games. I have seen this in socially weak children. They deserve a much better score than the one they got in the game.

Suggestions for Game-Based Assessment

Regarding the third subproblem of the study, classroom teachers' suggestions for using game-based assessment in mathematics lessons were grouped into three subcategories: suggestions for teachers, suggestions for students, and other suggestions.

Table 6 Suggestions for Game-Based Assessment in Mathematics Lessons

Category	Subcategory	Code	f
Suggestions	To teachers	Cooperation	5
		Identify common evaluation criteria	8
		Material completion	3
		Identifying level-appropriate games	2
		Group evaluation	2
		Application in the form of a competition	3
		Gain consolidation	6
		Time planning	4
	To students	Separation into groups	3
		Active participation	7
		Following instructions	5
		Cooperation	5
	Other	Application guide	8
		Providing instructions	8
		Material support	6
		Supporting textbooks	7

When Table 6 is analyzed, eight codes for teacher suggestions and four for student and other suggestions are found.

For teachers, the codes are as follows: Cooperation five, determining common evaluation criteria eight, completing materials three, identifying level-appropriate games two, group evaluation two, competition three, combining learning outcomes six, and time planning four. The opinions of the teachers in this category are exemplified below.

T7: To tolerate the lack of a guide, it would be easier if the teachers at least determine games among themselves. Cooperation can be done through social platforms or among themselves to exchange games and evaluation criteria.

T2: Teachers can form groups and evaluate with standard criteria.

T3: The materials of the identified games can be listed, and the missing materials can be obtained in advance.

T3: Games that are neither difficult nor easy for the class level should be produced by adhering to the principle of student relativity.

T2: It is impossible to evaluate a student alone in games played with a group; students can be evaluated by making a general scoring.

T1: Games can be applied as competitions, and time can be saved.

T5: Since it will be challenging to find games for each outcome for assessment with games, close outcomes can be combined and measured in a single game.

T6: Assessment with games creates time problems, so a plan should be made and proceed accordingly.

The codes for students are as follows: separation into groups, three; active participation, seven; following the instructions, five; and cooperation, five. The opinions of the teachers in this category are exemplified below.

T4: Students will find it easier to apply the games by separating into groups. They will progress in cooperation.

T6: Producing games that appeal to the whole class should ensure active participation. Students' participation in the evaluation will ensure that the evaluation is qualified. Students should not say, "I don't want to play this game."

T8: To provide a practical and accurate assessment, we must ensure that children understand and apply the instructions correctly. Their full compliance with the instructions will ensure that the assessment is correct for them.

T5: Students who are more familiar with the games and lessons can help others and play games together.

Other codes are as follows: support for the application guide eight, providing instructions seven, material support six, and supporting textbooks seven. The opinions of the teachers in this category are exemplified below.

T1: Teachers can be guided by sending a guidebook or a list of games in another way.

T7: I would expect instructions to manage the process of implementing the games well. It would be less tiring. We could better plan the application time.

T3: The materials should be complete, and the class size should be appropriate in order to apply the designed games quickly and effectively.

T7: I need help finding textbooks for the game. If we make the game indispensable for so many lessons, it should be included more in the textbooks.

Conclusions and Discussion

Based on the study's findings, it was revealed that there are positive and negative aspects of game-based assessment in elementary school mathematics lessons in terms of teachers, students, and the lessons themselves.

According to the results obtained regarding the positive aspects of play-based assessment, game-based assessment was a positive development because it allowed teachers to make long-term observations and observe behavior during the game. This result is important in allowing teachers to make objective and permanent evaluations. The fact that teachers use games to get to know the child in the preschool period overlaps with our research results and indicates that games can be an evaluation tool (Çelik & Demirbaş, 2023; Okatan & Tagay, 2021; Skillen et al., 2023). Gür and Kobak Demir (2016) found that using games in mathematics lessons provides instant feedback and supports permanent learning, consistent with our research results. According to this result, it is understood that classroom teachers can use game-based assessments to closely observe their students' mathematics performances in mathematics lessons.

While game-based assessment is supported because it will contribute to students' social aspects, such as having fun during a game, desire to win, active participation, and gaining competition experience, it is seen as an application allowing students to escape exam stress. A study conducted with higher education students revealed that their exam anxiety decreased, and their exam performance increased significantly in game-based assessment (Mavridis & Tsiatsos, 2017). Using game-based activities is seen as having

positive effects in providing active participation, learning with fun, and increasing social interaction between students (Çil & Sefer, 2021; Şentürk, 2020). Unlike traditional methods, measurement and evaluation have become a process today. This study investigated whether games can be used as a process assessment tool in mathematics lessons. Unlike traditional assessment and evaluation practices, process-based assessments give permanent and successful results (Ergül & Doğan, 2022). Therefore, teachers can use game-based assessments to distract students from exam stress and socialize them.

When examined in terms of mathematics lessons, it was evaluated that they would positively contribute to making boring and fearful mathematics lessons fun and breaking prejudice against the lesson. It has been revealed in related studies that using games in mathematics lessons develops a positive attitude in children, increases interest (Demir, 2016), and increases student motivation (Tayfur, 2019). Mathematics teachers stated that game-based applications would reduce prejudices against mathematics and thus make the mathematics lesson more concrete and fun by getting rid of abstractness (Özata & Coşkuntuncel, 2019) in the study in which the systems in our body unit of the science course was evaluated using game-based assessment, an increase in students' motivation and academic achievement was observed, indicating that game-based assessments can be used in other courses (Tayfur, 2019). Games are used in mathematics courses to develop mathematical skills beyond procedural skills, including mathematical reasoning (Olson, 2007), conceptual understanding (Clarke & Roche, 2010), and problem-solving (Karayol & Temel, 2018; Pintér, 2010; Russo et al., 2021). Based on the results obtained in this study, it is understood that games can be used in the assessment and evaluation processes of mathematics courses in primary school.

According to the results obtained regarding the negative aspects of game-based assessment in the study, it was stated that it would not be possible to conduct game-based assessments in mathematics lessons due to the lack of common criteria and application guidelines. It was revealed that this situation would lead to results that could not be evaluated objectively and reliably. This result shows that scoring by using teachers' personal opinions or by observing students' instant performances will vary from person to person. However, it is essential to evaluate each student's mathematics performance in a way that does not change according to objective criteria and personal opinion. Students need to see and complete their deficiencies according to their performance in terms of measurement and evaluation principles. In order to comply with these principles, the primary school

mathematics curriculum requires teachers to use tools such as checklists, follow-up tests, observation forms, portfolios, performance tasks, and rubrics to assess learning outcomes (MoNE, 2024a). However, although teachers express positive opinions about alternative assessment and evaluation approaches, it is known that they do not use these tools and prefer written exams and tests instead (Karakuş, 2010). Since formative assessment positively affects mathematics achievement, attitudes toward mathematics, and recall, teachers should be supported using these tools (Tekin, 2010). Therefore, teachers should be encouraged to use assessment tools they cannot use personal judgment for; teachers should be supported with implementation guides to objectively carry out assessment and evaluation processes.

The student's inability to focus on the mathematics subject by focusing only on having fun emerged as a negative opinion. In addition, not following the instructions during a game, not adapting to group games, and not following the game's rules may prevent the evaluation process from being carried out in a qualified manner. It may cause students to be excluded by their peers. Even each student's performance cannot be fully observed because they cannot adapt to group games. Therefore, it would be helpful to use interview forms, checklists, rating scales, and rubrics to evaluate students' performances according to the criteria specified in the forms and provide feedback (MoNE, 2024a). Monitoring practices aimed at identifying and raising such learning deficiencies will give the student the idea of recovering, participating in the lesson, paying attention, and thus reminding them of their responsibility for learning (Hotaman, 2020). In addition, Zengin et al. (2017) determined that Kahoot! and Plickers software have positive contributions, such as being applicable in the formative assessment process of mathematics teaching, facilitating assessment, and saving time by providing detailed and instant data analysis, which shows that student's attention can be attracted with digital tools. Therefore, students for whom having fun is of secondary importance should be assessed with appropriate assessment tools that reveal their actual performance. Ketamo and Devlin's (2014) finding that students who play too many games experience major conceptual misunderstandings during the game also supports our research findings. In addition, related research also stated that real-time game-based assessment is not yet ready to replace PISA to assess students “at the global level.”

The lack of time for the subjects and the inability to prepare appropriate games for each subject were negative assessment features with games in mathematics lessons. Trying to assess each subject with a game, taking more time than planned, or not having a suitable game for each outcome will negatively affect the quality of the lesson. Skillen et al. (2023)

examined the effects of a game-based assessment tool developed to measure the mathematical competence of preschool children. While the developed game was successful in at least 80% of low-achieving children, a negative feature emerged due to the time-consuming implementation of the game. Similarly, the fact that the preparations for the activities and in-class applications take too much time and that the activities make classroom management difficult are defined as the adverse effects of game-based activities (Çil & Sefer, 2021). Preparing games in which more than one subject or outcome will be assessed with a single game and assessing students at appropriate times will minimize the negative aspects of game-based assessment.

The difficulties encountered during game-based assessment in primary school mathematics lessons were grouped into three categories: before, during, and after the implementation. According to the results obtained from these categories, it was concluded that the lack of knowledge of teachers before starting the application, the lack of an application guide, the inability to prepare a game suitable for each outcome, and the lack of predetermination of evaluation criteria by teachers led to the results that the evaluation results could not provide reliable results. Regarding using educational mathematics games in mathematics teaching, mathematics teachers stated that it was challenging to prepare games for each outcome (Özata & Coşkuntuncel, 2019). Similarly, pre-service classroom teachers failed to design games at a satisfactory level in the dimensions of "game rules," "goals and objectives," "outcomes and feedback," and "interaction" (Pilten et al., 2017). The fact that teachers know the games they will use before starting game-based assessment and are prepared for the materials, duration, scoring instructions, etc., required by these games will ensure that the assessment is carried out more healthily.

During the application, it was determined that the game took too much time, there were no materials suitable for the assessment, the game was not suitable for the level of the students, and the textbooks did not support game-based assessment, which would lead to the lessons to be taught quickly or to be completed before they were fully completed, so the assessment could not achieve its purpose and valid results could not be obtained. The limitations encountered regarding the lack of materials and time in game-based mathematics lessons can be considered similar results (Gür & Kobak Demir, 2016). Another study concluded that games in game-based mathematics activities took too much time and made classroom management difficult (Çil & Sefer, 2021). In addition, teachers stated that educational mathematics games make classroom management difficult; games take too

much time and are difficult to use in crowded classes (Özata & Coşkuntuncel, 2019). Therefore, it can be considered an important variable that the necessary materials and textbook support should be completed in order for the game-based assessment to be carried out in a qualified manner and that the process should be carried out without being rushed during the evaluation.

After the implementation, teachers evaluated assessment with games negatively because personal assessment cannot be made when group games are played, there will be incomplete scoring because there is not a game suitable for every outcome, there will be differences in scoring according to the student or teacher, and scoring cannot be done in accordance with personal success due to the performance brought by group games. While it has been determined that classroom teachers mainly apply performance assessment, portfolio, project, and self-assessment techniques and that feedback is the most common performance indicator of the techniques applied, it is known that classroom teachers are inadequate in alternative measurement and evaluation (Özenç & Çakır, 2015). The results of this study show that having appropriate assessment tools and rubrics for group or individual games ready in advance will enable objective scoring after the implementation.

The suggestions of the interviewed teachers for game-based assessment in primary school mathematics lessons were grouped into three categories: teachers, students, and others. According to the results obtained from these categories, it was suggested that teachers cooperate in determining common games, sharing materials, determining common assessment criteria, and combining learning outcomes to make a qualified assessment with games in mathematics lessons. In addition, it is recommended that games appropriate for each student level be determined in the classroom, and games should be designed in the form of competitions or in a way that supports group assessment to save time. Çil and Sefer (2021) determined that classroom teachers need inexpensive and easy-to-prepare materials to implement game-based activities, which coincides with our research findings. In addition, allowing teachers to organize the outcomes and the time allocated to the outcomes more freely will reduce classroom teachers' concerns about time and use game-based mathematics activities more frequently (Çil & Sefer, 2021). Based on this result, it would be appropriate for teachers to determine appropriate games to evaluate all their students, cooperate to complete the necessary materials, and apply these games in groups or in the form of competitions.

The teachers' suggestions for students to be divided into groups, to actively participate in this process by acting according to the instructions, and to cooperate were presented by the teachers as suggestions for the students to assess with games in a more qualified way. This result shows that game-based assessment in mathematics lessons should be handled not only with the teacher dimension but also with the student dimension. Similarly, Skillen et al. (2023) supported our research results by stating that there is a need to take the opinions of experienced teachers and children about game-based assessment and to conduct studies that reveal the advantages or disadvantages of game-based assessment compared to traditional tests. Students exposed to assessment should take this process seriously and actively participate to demonstrate their performance accurately.

Apart from these suggestions, having a guide that shows the game list, materials, duration, application instructions, and in which achievements the game can be used; organizing the activity and assessment sections (such as theme assessment) in the textbooks in a way to support the games are presented as important suggestions for a more qualified assessment with games. The inclusion of game-based activities in the first-grade mathematics textbooks prepared in accordance with the 2024 primary school mathematics curriculum can be considered a positive development in this respect (MoNE, 2024b). However, it is among the responsibilities of teachers to determine the criteria for these activities to evaluate students' mathematical skills. The research results suggest that the Ministry of National Education should prepare a booklet for classroom teachers to use in mathematics lessons for each grade level. This booklet provides teachers with a detailed description of each stage, from the game they can use to the scoring key.

Limitations

This study was conducted using a phenomenology design, one of the qualitative research designs. The research is limited to eight classroom teachers working in Edirne and Kırklareli provinces in the 2023-2024 academic year who volunteered to participate in the interview. The data obtained are limited to the semi-structured interview form containing six questions created for this study. The data obtained from interviews with each teacher is limited to approximately 30 minutes.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest

The authors declare that they have no competing interests.

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CRediT author statement

The first author developed the initial idea and then designed the study. The first author managed the research process and guided the data collection. The second author collected all the data under the supervision of the first author. The first and second author worked together in all data analyses and writing the manuscript.

Research involving Human Participants and/or Animals

This study was carried out taking into account ethical rules. The participants were informed about the study and asked to sign a consent form voluntarily. The research was approved by the decision numbered 05/26 of the Trakya University Social and Human Sciences Research Ethics Committee at its meeting dated 29.05.2024. The data of the study was collected in the second semester of the 2023-2024 academic year.

Matematik Dersinde Oyun Temelli Değerlendirmeye İlişkin Sınıf Öğretmenlerinin Görüşleri: Fenomenolojik Bir Araştırma

Özet:

Araştırmanın amacı ilkokulda oyun temelli değerlendirme yapmanın matematik dersindeki yansımalarına ilişkin sınıf öğretmenlerinin görüşlerini almaktır. Çalışma nitel araştırma desenlerinden olgu bilim (fenomenoloji) desenine göre yapılandırılmıştır. Çalışmanın katılımcıları 2023-2024 eğitim öğretim yılında Edirne ve Kırklareli illerindeki devlet okullarında görev yapan sekiz sınıf öğretmeninden oluşmaktadır. Katılımcılar amaçlı örnekleme yöntemlerinden kolay ulaşılabilir örnekleme yöntemiyle belirlenmiştir. Çalışmanın verileri altı sorudan oluşan yarı-yapılandırılmış görüşme formu ile toplanmıştır. Veriler içerik analizi yöntemiyle analiz edilmiştir. Elde edilen bulgular ışığında; öğretmenler açısından uzun süreli gözlem yapma ve davranışa dönüşen kazanımı görme; öğrenciler açısından eğlenerek öğrenme, kazanma isteği, aktif katılım, yarışma deneyimi kazanma ve sınav stresini azaltma; ders açısından derslerin eğlenceli yürütülmesi ve derse olan ön yargının kırılması kodları ile oyun temelli değerlendirme olumlu bir gelişme olarak değerlendirilmiştir. Tarafsız değerlendirme yapamama ve değerlendirme güvenirliğinin düşük olması öğretmenler açısından; dikkat ve ilgi eksikliği, eğlenmeye odaklanma, oyun kurallarına uymama ve yönergeleri uygulayamama öğrenciler açısından; konuların yetişmemesi ve her kazanıma uygun oyunun hazırlanamaması matematik dersi açısından olumsuz yönler olarak görülmüştür. Matematik derslerinde oyun temelli değerlendirme yapılırken karşılaşılan güçlüklerin giderilmesine yönelik; değerlendirme kriterlerinin belirlenmesi, işbirliğini ve aktif katılımı teşvik etme, kazanım birleştirme, yönergelere uyma, uygulama kılavuzu hazırlama ve materyal tamamlama gibi önerilerde bulunulmuştur.

Anahtar kelimeler: Oyun temelli değerlendirme, ilkokul matematik dersi, öğretmen görüşleri, fenomenoloji.

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