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Research Article

Mathematics Is Scary: Efforts To Improve Junior High School Students' Perceptions of Mathematics Lessons Through Mathematics Games

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ABSTRACT

Mathematics is often perceived as a challenging and intimidating subject, especially at the junior high school level. This study aims to examine the impact of mathematical games on improving students' perceptions of mathematics. A pre-experimental design with a one-group pretest-posttest was utilized, involving 121 junior high school students aged 13–14 years. Students' perceptions were measured using a validated questionnaire before and after the intervention, and the data were analyzed using a paired sample t-test. Results revealed a significant increase in students' perceptions, as indicated by a *p-value* of 0.00116593×10^{-33}, which *p-value* is smaller than the threshold of 0.05. The findings confirm that mathematical games effectively shift students' perceptions of mathematics from negative to positive. This research underscores the importance of innovative teaching methods, such as game-based learning, in creating engaging and supportive learning environments that foster positive attitudes toward mathematics.

Keywords: Perception; Mathematics; Mathematical Games

1. INTRODUCTION

In a mathematics learning lecture taught by researchers to prospective teachers at the faculty of teacher training and education, prospective teachers conveyed the results of their observations regarding students' difficulties in understanding mathematics and the factors that cause these difficulties. It was revealed that more than 50% of students in junior high schools observed by prospective teachers considered mathematics as something difficult and unpleasant. Some even described mathematics as something "scary" that caused fear or boredom before the lesson began. Difficulty in solving story problems and the lack of strategies or formulas to solve them were challenges that were often mentioned, making mathematics feel like an unsolvable puzzle.

Mathematics is often perceived as a scary subject, especially at the junior high school level. This perception is frequently fueled by the stigma that mathematics is only for high-achieving students and is inherently dull or complicated. Such negative perceptions can significantly impact students' motivation and learning outcomes (Kulkin, 2016; Palullu et al., 2022). For instance, while 45% of students deem mathematics difficult, 80% acknowledge its importance in daily life (Siregar & Restati, 2017). Mathematics is crucial for technological development and equips students to navigate the digitalized society of the 21st century (Gravemeijer et al., 2017; Ünal, 2017; Anjariyah et al., 2022). Mathematics is a fundamental subject taught in schools worldwide, reflecting its universal importance in education. This is evident from its inclusion as a core competency in the Program for International Student Assessment (PISA), which assesses the abilities of over 600,000 students from 78 countries (Feriyanto et al., 2023). This global focus underscores the urgency of implementing effective teaching strategies to help students not only master mathematical skills but also build confidence in their abilities.

Perception is defined as an individual's assessment or view of an object, influenced by experience, knowledge, and emotions (Fitriani et al., 2022). In the context of mathematics, students' perceptions shape their confidence, interest, and ability to engage with the subject. Negative perceptions often lead to math anxiety, characterized by low participation and poor academic performance (Arambasic et al., 2005). Interactive and engaging activities have been proposed as a means to shift students' perceptions from negative to positive (Darhim, 2008; Anjariyah et al., 2023).

Mathematics is an important discipline in developing logical, critical, and creative thinking skills. However, a less interesting learning approach often makes students lose interest and motivation to learn it (Pratiwi & Dewi, 2022). One approach that can be used to overcome this is math games. Math games are interactive activities designed to teach mathematical concepts in a fun and challenging way. Some examples of games used to support mathematics learning are the uno spin math card game (Najiah, 2021), Monopoly Game (Rahaju & Hartono), lego games (Wardani & Nasution, 2022), interactive wordwall-based games (Triani, 2023). Research shows that math games can improve students' motivation,

interest in learning, and understanding of the material (Kurniati et al., 2022; Muthianisa & Anggarani, 2019). For example, math crossword puzzles and math Bingo effectively reinforce the concept of integer operations and flat shapes (Rahmadhani et al., 2021; Badjeber & Suciati, 2021).

This study focuses on the novel aspect of examining the effect of math games on junior high school students' perceptions of mathematics, shifting the emphasis from learning outcomes to perceptual changes. Previous studies have demonstrated that games can foster a fun learning environment, reduce anxiety, and boost participation (Darhim, 2008; Wahyu Wijayanti, 2021). However, limited research has explored this topic at the junior high school level. This study aims to assess the effectiveness of math games in improving perceptions of mathematics and to contribute to more inclusive and engaging instructional strategies.

2. RESEARCH METHOD

This study employed a quantitative approach with a pre-experimental design, specifically a one-group pretest-posttest design. This design was selected because it facilitates the measurement of changes within a single group following the intervention (Creswell, 2014). Data were collected twice—before and after the intervention—to evaluate its effectiveness (Campbell & Stanley, 1963). The sample comprised 61 junior high school students from Mojokerto Regency, selected through purposive sampling based on criteria relevant to the research objectives (Etikan, Musa, & Alkassim, 2016). A validated perception questionnaire was used to ensure reliable and accurate measurements. Data analysis was performed using a paired sample t-test, an appropriate statistical technique for comparing mean scores before and after the intervention in the same group (Field, 2013). The analysis was conducted using Microsoft Excel.

3. RESULTS AND DISCUSSION

Students' perceptions of mathematics were measured using questionnaires administered individually before and after the implementation of math games in learning. The intervention included two types of games: online game-based and manipulative media-based. In online game-based activities, students individually solve math problems prepared on the Quizizz platform. The problems are designed with varying levels of difficulty to encourage conceptual understanding and the application of problem-solving strategies. Students are given a maximum of 20 minutes to complete the tasks to maintain focus. The competitive features offered by Quizizz, such as point scoring and real-time ranking, have been shown to enhance student engagement during the learning process.

Meanwhile, in manipulative media-based activities, students work in groups to complete tasks involving acrylic manipulatives in the form of flat-sided geometric shapes with different colored faces. This activity is designed to help students understand the properties and concepts of geometric nets through hands-on exploration. Students are asked to identify the properties of geometric shapes and then search for and arrange nets corresponding to the shapes. From the identified nets, students are challenged to calculate the surface area of the geometric shapes. Each group is given a maximum of 40 minutes to complete the challenge, emphasizing teamwork and collaboration.

Figure 1. Student Activities in the Game of Finding Nets and Surface Areas of Geometric Shapes Using Children's Toys

Based on the data of students' perception scores, it is analyzed whether the data provides sufficient evidence to state that the mean of students' perception after the math game is greater than the mean of students' perception before the application of the math game. So that the formulation of the hypothesis formed is:

H_o : $\mu_B = 0$, The math game intervention does not improve students' perceptions

H_1 : $\mu_B > 0$, The math game intervention improves students' perceptions

Description:

μ_1 = average student perception before receiving the application of the math game

μ_2 = average student perception after receiving the application of the math game

$\mu_B = \mu_1 - \mu_2$ = difference in the average of students' perception before and after implementation of the math game

After the data is entered in the Ms. Excel worksheet, an analysis is carried out by selecting the t-test for two paired sample means. The results will appear as follows:

t-Test: Paired Two Sample for Means

	Student Perception Score Before Implementation of Math Games in Learning	*Student Perception Score After Implementation of Math Games in Learning*
Mean	59,80165289	83,15702479
Variance	219,1269972	42,88347107
Observations	121	121
Pearson Correlation	0,326134454	
Hypothesized Mean Difference	0	
df	120	
t Stat	-18,22183232	
P(T<=t) one-tail	1,16593E-36	
t Critical one-tail	1,657650899	
P(T<=t) two-tail	2,33186E-36	
t Critical two-tail	1,979930405	

Figure 2. Display of T-Test Data Analysis Results in Ms. Excel

In this case, we use a one-tailed test so that the significant value seen is one tail. The results of the study indicate that the implementation of math games has a significant effect in improving junior high school students' perceptions of mathematics subjects. Based on the t-test analysis for two paired sample averages, a significant value of $p = 0.00116593 \times 10^{-33}$ is obtained which is smaller than $\alpha = 0.05$. Because $p < 0.05$, reject H_0 and accept H_1, which means that there is a significant difference between students' perceptions before and after the implementation of math games. This supports the research hypothesis that the implementation of math games can improve students' perceptions positively. Before the implementation of math games, the average student perception was at 59.8, which was categorized as a negative perception. After the implementation of math games, the average perception increased to 83.2, which was included in the positive perception category. This finding is consistent with previous studies stating that a game-based learning approach can create a fun learning atmosphere, reduce anxiety, and increase students' motivation and interest in learning (Darhim, 2008; Kurniati et al., 2022).

This change in perception can be explained by several factors, including the active involvement of students in game-based learning, either through online game media such as Quizizz or manipulative media such as children's toys in the form of geometric shapes. Previous studies stated that technology-based math games or interactive teaching aids can increase students' interest in even difficult material (Najiah, 2021; Rahmadhani et al., 2021). This approach not only increases collaboration within the team but also strengthens students' understanding of the mathematical concepts being taught (Anjariyah, 2024). From the game of finding the surface area of geometric shapes, several documents were produced as follows.

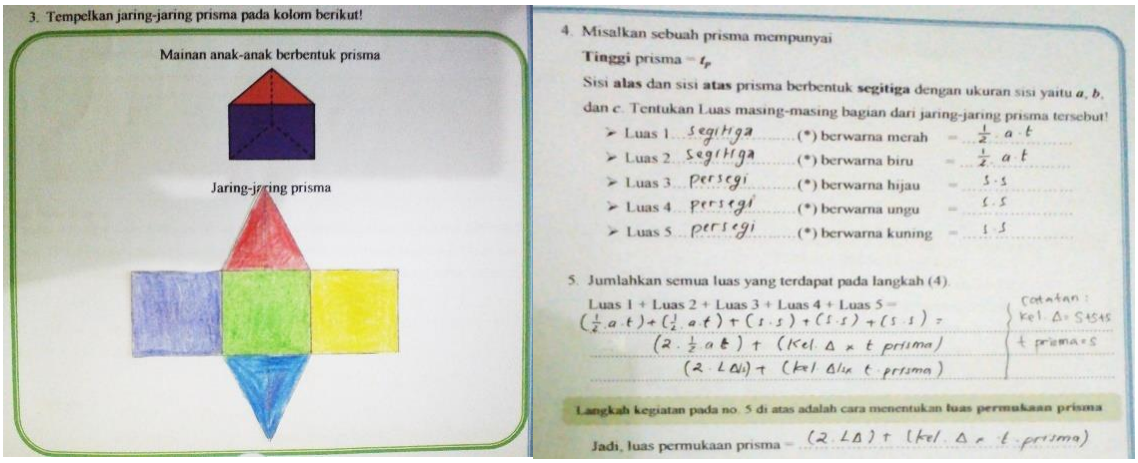

Figure 3. Nets and Surface Areas of Solid Geometry Found by Students

The discovery of concepts related to solid geometry in this math game can indirectly be part of guided discovery-based learning. This can be an innovative approach to learning that combines active student exploration with game elements to improve conceptual understanding. In this method, the teacher provides direction and guiding questions, while students actively explore learning materials through interactive and fun game-based activities. According to Joyce et al. (2015), discovery-based learning allows students to build their own understanding of new concepts through direct experience, which is reinforced with the help of games that provide real context and motivation. Meanwhile, Prensky (2007) stated that elements of competition, challenge, and instant feedback in games can increase student engagement and motivate them to solve problems independently. Thus, the combination of these two approaches not only supports mastery of academic material, but also encourages 21st-century skills such as collaboration, creativity, and critical thinking skills.

This study also supports the view that students' perceptions of subjects are influenced by their learning experiences. When learning is carried out with fun methods and involves visual and kinesthetic aspects, students are more likely to feel confident and interested in learning. This finding is in line with the theory that positive perceptions of mathematics lessons can reduce anxiety and increase student participation in learning (Arambasic et al., 2005; Fitriani et al., 2022). In addition to having an impact on perception, math games also contribute to 21st-century skills, such as critical thinking, creativity, and collaboration. This study emphasizes the importance of innovation in mathematics learning as an effort to change the negative stigma that has been attached to the subject. By using an inclusive and engaging approach, teachers can create a more conducive learning environment and empower students as a whole.

4. CONCLUSION

This study highlights that implementing mathematical games significantly enhances middle school students' perceptions of mathematics. Data analysis using a t-test for paired two-sample means, assisted by Microsoft Excel, revealed a significance value (P(T<=t) one-tail) $0.00116593 \times 10^{-33}$, which is well below the threshold of 0.05. This result indicates a statistically significant difference between the average perception scores of students before and after the intervention. Specifically, the mean perception score increased from 59.8 (classified as a negative perception) before the intervention to 83.2 (classified as a positive perception) afterward, underscoring the effectiveness of this approach in reshaping students' views of mathematics. The successful integration of mathematical games has been shown to reduce the stigma of mathematics as a challenging and intimidating subject while fostering a more enjoyable and interactive learning environment. These games provide students with opportunities to grasp abstract concepts through engaging and practical methods, thereby boosting their motivation and interest in learning. The findings align with previous studies on the advantages of game-based learning, which emphasize its role in promoting positive educational experiences.

The implications of this study are profound for both educational practices and policy-making. Integrating mathematical games into the curriculum offers a scalable approach to improving students' attitudes toward mathematics. Schools should consider offering professional development programs to equip teachers with the skills needed to design and implement effective mathematical games. Moreover, future research could broaden the scope by including larger and more diverse samples to validate the findings across different educational levels and regions. Longitudinal studies may provide further insights into the lasting impact of mathematical games on students' perceptions, motivation, and academic performance. Investigating the application of technology-based mathematical games and identifying the most effective game types for teaching specific concepts can offer additional valuable contributions. Including teacher feedback in future studies will also enhance our understanding of the practical challenges and benefits of using mathematical games in classrooms.In conclusion, the implementation of mathematical games has been validated as an effective strategy to improve students' perceptions of mathematics while reducing its negative stigma. Continued exploration and innovation in this area are essential to fostering more engaging and positive mathematics learning environments.

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