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Putri Anggun^{a*}, Rusdi^b Rusdib,
Tasnim Rahmat^c, Nola Nari^d,
Denilson Andrés Silgado-Tuñón^e

^{a*}Department of Mathematics Education,
UIN Sjech M. Djamil Djambek,
Bukittinggi, Sumatera Barat, Indonesia,
putrianggunn2001@gmail.com

^bDepartment of Mathematics Education,
UIN Sjech M. Djamil Djambek,
Bukittinggi, Sumatera Barat, Indonesia,
rusdi@uinbukittinggi.ac.id

^cDepartment of Mathematics Education,
UIN Sjech M. Djamil Djambek,
Bukittinggi, Sumatera Barat, Indonesia,
tasnimrahmat@uinbukittinggi.ac.id

^dDepartment of Mathematics Education,
UIN Sjech M. Djamil Djambek,
Bukittinggi, Sumatera Barat, Indonesia,
nolanari@uinbukittinggi.ac.id

^eDepartment of Mathematics Education,
Autonomous University of Zacatecas,
Zacatecas, Mexico,
denilson.silgado@uaz.edu.mx

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Filling the gap in quizizz paper mode research: Its effect on mathematics learning interest at the junior secondary level

Putri Anggun^{a*}, Rusdi Rusdi^b, Tasnim Rahmat^c, Nola Nari^d, Denilson Andrés Silgado-Tuñón^e

^{a*}Department of Mathematics Education, UIN Sjech M. Djamil Djambek, Bukittinggi, Sumatera Barat, Indonesia, putrianggunn2001@gmail.com

^bDepartment of Mathematics Education, UIN Sjech M. Djamil Djambek, Bukittinggi, Sumatera Barat, Indonesia, rusdi@uinbukittinggi.ac.id

^cDepartment of Mathematics Education, UIN Sjech M. Djamil Djambek, Bukittinggi, Sumatera Barat, Indonesia, tasnimrahmat@uinbukittinggi.ac.id

^dDepartment of Mathematics Education, UIN Sjech M. Djamil Djambek, Bukittinggi, Sumatera Barat, Indonesia, nolanari@uinbukittinggi.ac.id

^eDepartment of Mathematics Education, Autonomous University of Zacatecas, Zacatecas, Mexico, denilson.silgado@uaz.edu.mx

*Correspondence: putrianggunn2001@gmail.com

Abstract

This research is motivated by the low interest in learning mathematics among students, which is thought to be caused by the lack of variety in the use of interactive and interesting technology-based learning media. In addition, the use of learning media that relies on mobile devices often causes distractions, making the learning process less effective. Therefore, this study aims to determine the increase in students' interest in learning mathematics through the use of interactive learning media *Quizizz* based on *paper mode* in grade VII students of MTsN 10 Agam. The type of research used is a pre-experimental study with a one-group pretest-posttest design. The study population was students of grades VII.1 and VII.2, while the research sample was class VII.1 selected using a cluster (class) random sampling technique. The research instrument was a questionnaire on interest in learning mathematics that had been validated and tested for reliability. Data analysis techniques used the t-test and N-Gain test. The results showed that the average score of students' interest in learning mathematics before treatment was 112.65 and increased to 140.20 after treatment. Based on the results of the t-test analysis, it was found that there was an increase in students' interest in learning mathematics after using the interactive learning media *Quizizz* based on *paper mode*. Furthermore, the N-Gain test result of 0.58 indicates that the increase in student learning interest is in the moderate category. Thus, the use of the paper-based interactive learning media *Quizizz* can increase students' interest in learning mathematics.

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1. Introduction

Education is a crucial aspect of human life, playing a role in improving the quality of human resources and shaping the nation's character (Imamuddin et al., 2019). Through education, humans acquire the knowledge, skills, and values needed for social life (Nari & Musfika, 2016). According to Ki Hadjar Dewantara, education is an effort to advance children's character, mind, and body, leading to a perfect life in harmony with nature and society (Nari et al., 2022). This opinion demonstrates that

education is not solely oriented toward academic aspects, but also focuses on personality formation and the development of students' overall potential.

In line with this, the goal of national education, as stated in the Preamble to the 1945 Constitution, is to advance the nation's intellectual life. Furthermore, Law Number 20 of 2003 concerning the National Education System explains that education aims to develop the potential of students to become individuals who believe in and fear God Almighty, possess noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens. Thus, education plays a crucial role in creating a quality generation capable of facing the changing times. One factor supporting a person's success in acquiring knowledge is a strong interest in learning (Putra et al., 2025). Interest in learning will encourage students to be more active, focused, and diligent in participating in the learning process, thereby optimally achieving learning objectives (Falochi et al., 2023).

In education, mathematics is a subject that plays a crucial role in developing logical, critical, systematic, analytical, and creative thinking skills (Cresswell & Speelman, 2020). Mathematics also serves as the foundation for the development of science and technology. Therefore, mathematics learning needs to be designed in such a way as to increase student engagement and understanding of the material being studied. However, in reality, mathematics learning is still often considered a difficult and boring subject by some students (Ashcraft & Krause, 2007). This condition results in low student interest in learning mathematics, which impacts student participation and engagement during the learning process (Fredricks et al., 2004).

Interest in learning is a person's sense of attraction and desire to engage in learning activities without coercion from others. Hidi & Renninger (2006) describe this as a shift from situational interest, sparked by engaging media, toward a more lasting individual interest. According to Santika et al. (2020), interest in learning is characterized by a student's enjoyment, attention, fascination, and involvement in the learning process. Students with a strong interest in learning tend to be more active in asking questions, paying attention to teacher explanations, and being motivated to complete learning assignments. Conversely, students with a low interest in learning tend to get bored easily, lack focus, and participate less in learning activities (Ayuni & Suryani, 2026). Student interest in learning is influenced by various factors, both internal and external. According to Papanastasiou (2000), internal factors include motivation, curiosity, and the student's physical condition, while external factors include the family environment, school environment, and the use of learning media by teachers in the learning process.

One effort teachers can make to increase student interest in learning is by using innovative and interactive learning media. Learning media are tools used to convey information and learning materials so that they are easier for students to understand. According to Mayer (2003), well-designed instructional media that combine multiple modalities can create an engaging, enjoyable, and non-monotonous learning environment, thus motivating students to participate. Technological developments in education are currently driving the emergence of various digital-based learning media that can increase student engagement in the learning process. Interactive learning media is a form of technology-based learning media that enables two-way communication between the user and the learning media (Moore, 1989). This media can combine elements of text, images, sound, video, animation, and educational games to capture students' attention throughout the learning process.

One interactive learning media that can be used in mathematics learning is Quizizz, a paper-based learning platform. Quizizz is an educational game-based learning platform that provides various interactive quiz features to support the learning process (Sunarko et al., 2025). Similar quiz-based platforms, such as Kahoot!, have shown comparable benefits for engagement and motivation internationally (Wang & Tahir, 2020; Alt, 2023; Ju & Adam, 2018). Over time, Quizizz introduced a

paper mode feature that allows students to take quizzes offline using sheets of paper equipped with QR codes or Q-Cards. This feature eliminates the need for students to use mobile phones or access the internet directly during learning (Nurholifah et al., 2023). Teachers simply display questions through their devices, and students then answer using the provided answer cards. The use of Quizizz paper mode is considered highly relevant in schools with limited technological facilities, such as limited electronic devices and internet access (Magfirah et al., 2025). Furthermore, paper mode can reduce distractions caused by mobile phone use during learning, allowing students to focus more on learning activities.

The use of the interactive learning media Quizizz has been extensively researched and has demonstrated positive results for the learning process. Research by Cahyani & Putranto (2024) demonstrated that the use of Quizizz paper mode has a positive and significant impact on student learning motivation in social studies. Research by Noviyanti & Rukmana (2025) also demonstrated that the use of Quizizz paper mode significantly impacted students' mathematics learning outcomes in spatial geometry. In addition, research by Muchuweni et al (2025) stated that the use of Quizizz paper mode can increase students' interest in learning science subjects. Another study by Narpila (2025) also showed that the attractive features contained in Quizizz can increase students' attention and engagement in learning. A recent international review by Muchuweni et al (2025) confirms this pattern holds across 25 studies from 2015–2024, well beyond the Indonesian context. However, research on the use of interactive learning media Quizizz based on paper mode to increase students' interest in learning mathematics at the MTs level is still relatively limited. Most previous studies have focused more on learning motivation, learning outcomes, or applied to different subjects and levels of education. Therefore, unlike prior Quizizz paper-mode studies that primarily targeted elementary-level learners or outcomes such as motivation and learning results, this study's novelty lies in specifically examining students' interest in learning mathematics among grade VII MTs students through Quizizz paper mode. Notably, the previously cited Quizizz paper-mode studies by Marsyanda & Rusnilawati (2026) and Narpila (2025) were conducted at the elementary school level, while Cahyani & Putranto (2024) and Noviyanti & Rukmana (2025) examined learning activity and learning outcomes rather than interest, underscoring the need for a dedicated investigation of interest at the junior-secondary (MTs) level. The closest related study, Lukman et al. (2023), developed gamified mathematics materials for junior high students but focused on problem-solving rather than interest, leaving this gap open.

Based on preliminary observations conducted at MTsN 10 Agam on February 7, 2025, it was found that the mathematics learning process in seventh grade was still dominated by the use of printed media such as textbooks and student worksheets. The use of technology-based learning media was still very limited and only used during specific assessments. Furthermore, not all students had mobile phones or adequate internet access to support digital-based learning. This situation made it difficult for teachers to implement digital learning media comprehensively in the classroom.

The observations also showed that students' interest in learning mathematics was still low. This was evident in their lack of enthusiasm during the lesson. Some students were seen resting their chins, yawning repeatedly, and frequently looking at the clock during the lesson. Students' concentration only lasted at the beginning of the lesson, then their attention began to be distracted by other activities such as chatting with their deskmates or drawing in their notebooks. Furthermore, students tended to be passive when the teacher posed questions or gave group assignments. During group discussions, only a few students were active, while others were less engaged in completing the assignments.

Based on interviews with teachers and seventh-grade students on February 11, 2025, it was discovered that students are actually more interested in learning using technology-based learning media because they consider it more engaging and less boring. However, the use of mobile phones in learning is often hampered by device limitations and internet quotas. Teachers also stated that using mobile

phones in learning sometimes causes distractions because students can open other applications outside of class. On the other hand, students want learning media that is engaging, interactive, easy to use, and independent of mobile phone or internet usage.

Based on these various challenges, innovative learning media is needed that can create an engaging and interactive learning environment, yet can still be used by all students without relying on electronic devices and internet access. The use of interactive learning media, Quizizz, based on paper mode, is expected to be a solution to increase students' interest in learning mathematics because this media allows all students to actively participate in learning through fun, interactive quizzes. Furthermore, the use of paper mode can also help teachers create more varied, effective, and school-specific learning environments. Therefore, this research is important to be conducted to determine the effect of using interactive learning media Quizizz based on paper mode on increasing the interest in learning mathematics of class VII students at MTsN 10 Agam.

2. Method

2.1 Research Design

This study employed a quantitative approach using a one-group pretest–posttest pre-experimental design. A pre-experimental design was selected because the study was conducted in a single intact classroom without a comparable control group, a condition commonly encountered in classroom-based educational research (Campbell & Stanley, 1963; Sugiyono, 2019). This design enabled the researchers to examine changes in students' mathematics learning interest before and after the implementation of the interactive Quizizz paper-based learning media. The formal structure of the experimental design is presented in Table 1, while the overall sequence of the research procedures is illustrated in Figure 1.

Table 1

Research Design

Pretest	Treatment	Posttest
O ₁	X	O ₂

Description:

O₁ = Pretest of students' mathematics learning interest

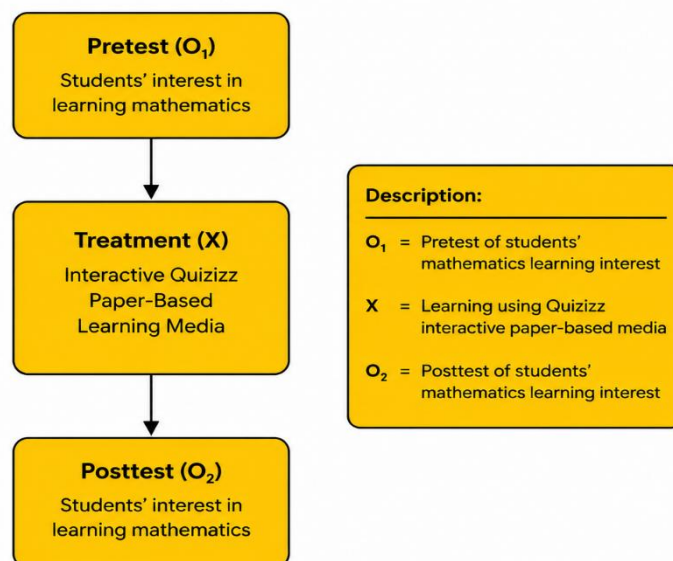
X = Learning using interactive Quizizz paper-based learning media

O₂ = Posttest of students' mathematics learning interest

As presented in Table 1 and illustrated in Figure 2, the study consisted of three consecutive stages: pretest (O₁), treatment (X), and posttest (O₂). Students first completed a pretest to determine their initial level of mathematics learning interest before receiving the intervention. The treatment involved mathematics instruction using interactive Quizizz learning media in paper-based mode. Following the completion of the instructional activities, students completed a posttest using the same instrument to evaluate changes in their learning interest after the intervention. Comparing the pretest and posttest scores allowed the researchers to determine the effectiveness of the instructional media in improving students' mathematics learning interest.

Figure 2

Research Design Flowchart



2.2 Participants

The study was conducted at MTsN 10 Agam, West Sumatra, Indonesia, during the even semester of the 2024/2025 academic year. The target population comprised all seventh-grade students enrolled at the school, consisting of two intact classes, namely Class VII.1 and Class VII.2, with a total of 44 students. Since the study adopted a one-group pretest–posttest pre-experimental design, only one class was required as the research sample. To ensure that each class had an equal probability of being selected, cluster random sampling at the class level was employed. Prior to the sampling process, preliminary statistical analyses were conducted using students' Mathematics Daily Assessment (Penilaian Harian) scores to verify the comparability of the two classes. These analyses included tests of normality, homogeneity of variance, and equality of means, which are commonly recommended to establish the equivalence of groups before selecting a representative sample in educational research.

The results of the preliminary analyses indicated that both classes were normally distributed, exhibited homogeneous variances, and did not differ significantly in their initial mathematics achievement, suggesting that the two classes possessed relatively similar academic characteristics. Following the confirmation of group equivalence, the research sample was determined through a computerized random drawing using the Wheel of Names application, thereby minimizing researcher bias during the selection process. The randomization resulted in Class VII.1 being selected as the experimental group. This class consisted of 20 students, all of whom participated in every stage of the study, including the administration of the pretest, the implementation of the Quizizz paper-based learning intervention, and the posttest. Consequently, the dataset used for statistical analysis was complete, with no participant attrition throughout the research period.

2.3 Data Collection

The data in this study were obtained from research instruments. The research instrument used was a questionnaire on students' interest in learning mathematics. The questionnaire was compiled based on Slameto's (2015) indicators of interest in learning, which include: (1) enjoyment, (2) interest, (3) attention, and (4) student involvement in mathematics learning. The instrument consisted of 40 statements using a Likert scale with four response options: Strongly Agree (SS), Agree (S), Disagree (TS), and Strongly Disagree (STS). The statements consisted of positive and negative items.

Before being used in the research, the instrument was first tested for validity and reliability. The validity test used content validity through expert judgment using the Aiken's V formula. The validation results showed that the instrument was in the valid to very valid category. Furthermore, the reliability test was conducted using the Intraclass Correlation Coefficient (ICC) with the help of SPSS version 26, indicating that the instrument had a good level of reliability. Data collection techniques were conducted through the distribution of pretest and posttest questionnaires on students' interest in learning mathematics. The pretest was administered before using the paper-based interactive learning media Quizizz, while the posttest was administered after the learning process was completed. During the learning process, the researcher implemented a Problem-Based Learning (PBL) model combined with the use of the paper-based interactive learning media Quizizz.

2.4 Data Analysis

Data analysis was conducted in stages. The first stage was a normality test using the Liliefors test through SPSS version 26 to determine whether the data were normally distributed. After the data were declared normal, a hypothesis test was conducted using a paired sample t-test to determine the average difference in students' learning interest before and after the treatment. The test was conducted at a significance level of 0.05. In addition, to determine the level of increase in students' learning interest, a normalized N-Gain test was used with high, medium, and low categories based on the criteria developed by Hake (1998). The hypothesis test followed a clear decision rule: the null hypothesis was rejected if t_{count} exceeded t_{table} at a significance level of 0.05, indicating a significant difference between pretest and posttest scores. For the N-Gain test, the resulting score was categorized as high ($g \geq 0.7$), moderate ($0.3 \leq g < 0.7$), or low ($g < 0.3$), following Hake's (1998) criteria.

3. Results and Discussion

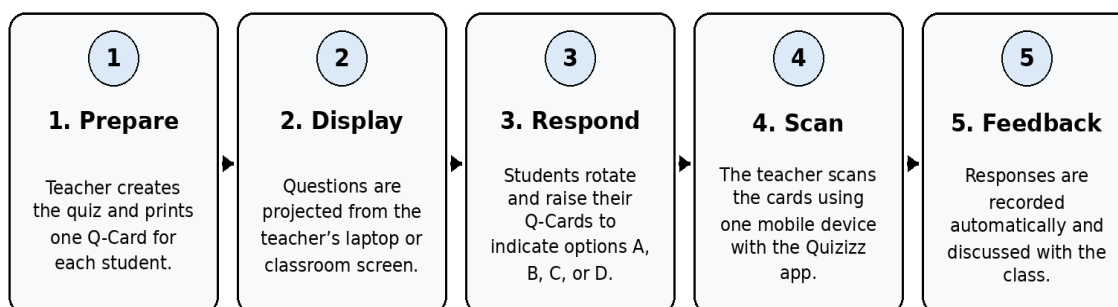
3.1 Results

This research was conducted in class VII.1 of MTsN 10 Agam, with 20 students. The aim of the study was to determine the effect of using the interactive learning media Quizizz, based on paper mode, on students' interest in learning mathematics. Data were obtained through the distribution of pretest and posttest questionnaires on students' interest in learning mathematics. The pretest questionnaire was administered before the treatment on September 23, 2025, while the posttest questionnaire was administered after the implementation of the interactive learning media Quizizz, based on paper mode, on September 24, 2025. The questionnaire instrument consisted of 40 statements that were validated by the validator.

The treatment was implemented by integrating the PBL model with Quizizz Paper Mode. Before each lesson, the teacher prepared the mathematics questions in Quizizz, activated Paper Mode, and assigned a numbered Q-Card to every student; a laptop displayed the questions while a mobile device scanned students' responses (Figure 1). During the lesson, the teacher first presented a contextual mathematics problem in accordance with the PBL stages; after students explored the problem individually or in groups, the related Quizizz question was displayed, and students selected an answer by rotating their Q-Card so the chosen option (A, B, C, or D) faced up before raising it for scanning (Figure 2). The teacher then displayed the response summary, discussed incorrect answers by asking students to explain their reasoning, and at the end of the lesson used the Quizizz report as formative information to identify difficult questions and plan follow-up instruction.

Figure 3

Operational workflow of Quizizz Paper Mode in the classroom



As illustrated in Figure 3, the implementation of the interactive Quizizz paper-based learning media followed a structured five-step procedure designed to facilitate active student participation while minimizing the need for individual digital devices. In the preparation stage, the teacher designed the Quizizz activity and distributed one Q-Card to each student. During the display stage, multiple-choice questions were projected onto the classroom screen, allowing all students to view the same question simultaneously. Students then entered the response stage by rotating and raising their Q-Cards to indicate their selected answers (A, B, C, or D). In the scanning stage, the teacher used a single mobile device equipped with the Quizizz application to scan students' responses efficiently, after which the application automatically processed the results. Finally, in the feedback stage, students received immediate feedback as the response distribution and correct answers were displayed and discussed collaboratively with the entire class. This systematic instructional procedure enabled the integration of formative assessment, immediate feedback, and active classroom engagement while overcoming the limitations associated with students' access to personal digital devices.

Figure 4

Example of Q-Card orientation for selecting an answer

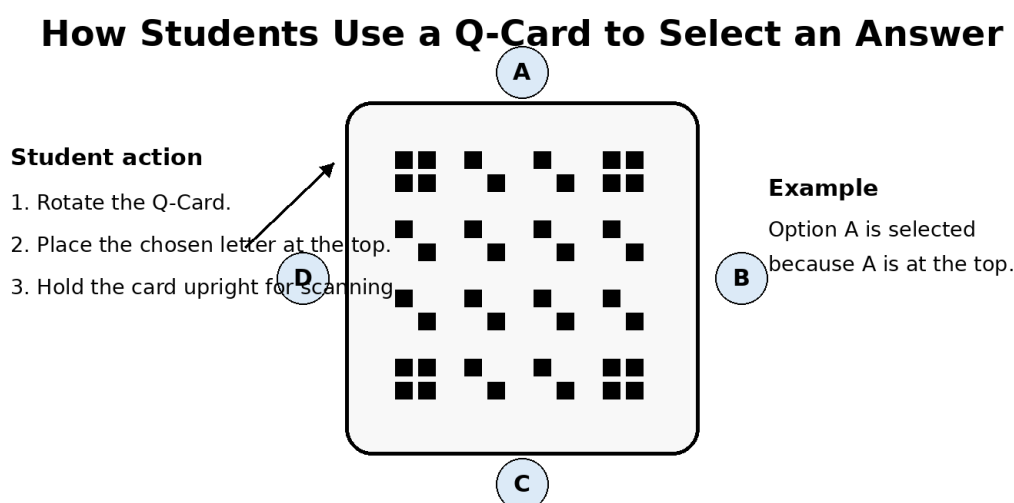


Figure 4 illustrates the mechanism by which students used the Q-Card to submit their answers during the Quizizz paper-based learning activities. Each Q-Card was designed with four answer indicators (A, B, C, and D) positioned on different sides of the card. To respond to a multiple-choice question, students rotated the card until the letter corresponding to their chosen answer was positioned at the top and then held the card upright for scanning. As shown in the example, placing A at the top indicated that the student selected option A. The Quizizz application recognized students' responses by detecting the

orientation of the Q-Card through the mobile device's camera, enabling rapid and accurate recording of answers without requiring individual smartphones. This paper-based response system not only simplified classroom assessment but also ensured equal participation opportunities for all students, particularly in learning environments with limited access to digital devices.

To provide a clearer overview of students' performance before and after the intervention, the descriptive statistics of the pretest and posttest scores are presented in Table 2.

Table 2

Description of Pretest and Posttest Results of Students' Interest in Learning Mathematics

Test	N	$\bar{x}$	S	S ²	Maximum	Minimum
Pretest	20	112.65	8.82	77.79	129	100
Posttest	20	140.20	13.08	171.09	160	117

Based on Table 2, students' interest in learning mathematics showed a substantial improvement following the implementation of the interactive Quizizz paper-based learning media. The mean pretest score increased from 112.65 to 140.20 in the posttest, representing an average gain of 27.55 points. This improvement suggests that the intervention contributed positively to enhancing students' interest in learning mathematics. Similarly, the highest score increased from 129 to 160, while the lowest score rose from 100 to 117, indicating that improvements occurred not only among high-achieving students but also among those who initially demonstrated lower levels of learning interest.

In addition to the increase in the average score, the standard deviation increased from 8.82 in the pretest to 13.08 in the posttest, accompanied by an increase in variance from 77.79 to 171.09. This finding indicates that although students generally demonstrated higher levels of learning interest after the intervention, the degree of improvement varied among individuals, resulting in greater score dispersion during the posttest. Nevertheless, the overall upward shift in the mean, together with the increases in both the minimum and maximum scores, provides preliminary evidence that the interactive Quizizz paper-based learning media was effective in fostering students' interest in learning mathematics. The statistical significance of these improvements is further examined through inferential analyses presented in the subsequent section. The following are the results of the prerequisite tests:

Normality Test

Before testing the hypotheses, a normality test was conducted on the pretest and posttest data to determine whether the data were normally distributed. The results of the normality test using the Liliefors test are shown in Table 3.

Table 3

Results of the Pretest and Posttest Normality Test

Test	N	L ₀	L _{table}	Descriptions
Pretest	20	0.168	0.190	Normally
Posttest	20	0.127	0.190	Normally

Based on Table 3, the L₀ value < L_{table} for both the pretest and posttest data. Therefore, it can be concluded that the pretest and posttest data are normally distributed, allowing for hypothesis testing using a paired sample t-test.

Hypothesis Testing

Hypothesis testing was conducted using a paired sample t-test to determine whether there was a difference in students' interest in learning mathematics before and after using the paper-based interactive learning media Quizizz. The results of the hypothesis testing can be seen in Table 4.

Table 4

Paired Sample t-Test Results

t_{count}	t_{table}
8.503	1.729

Table 4 presents the results of the paired-samples *t*-test conducted to examine whether students' interest in learning mathematics differed significantly before and after the implementation of the interactive Quizizz paper-based learning media. The analysis yielded a calculated *t* value of 8.503, which exceeded the critical *t* value of 1.729 at the 0.05 significance level with 19 degrees of freedom. This finding indicates a statistically significant difference between the pretest and posttest scores, leading to the rejection of the null hypothesis. Therefore, the results provide strong evidence that the implementation of the interactive Quizizz paper-based learning media significantly improved students' interest in learning mathematics. The substantial increase in the mean score observed in the descriptive analysis is thus supported by inferential statistical evidence, confirming that the observed improvement was unlikely to have occurred by chance.

Further statistical analysis revealed a two-tailed significance level of $p < .001$, indicating a very high level of statistical significance. In addition, the calculated effect size (Cohen's $d = 1.90$) demonstrated a large practical effect, substantially exceeding the conventional benchmark for a large effect ($d = 0.80$). This result suggests that the intervention not only produced statistically significant improvements but also generated meaningful educational benefits in enhancing students' interest in learning mathematics. The combination of a highly significant *p*-value and a very large effect size indicates that the Quizizz paper-based learning media was highly effective in promoting students' engagement and positive attitudes toward mathematics learning within the context of this study.

Normalized N-Gain Test

To determine the level of improvement in students' interest in learning mathematics, a normalized N-Gain test was conducted. The results of the N-Gain test analysis can be seen in Table 5.

Table 5

Normalized N-Gain Test Results

Test	N	Mean	N-Gain	Criteria
Pretest	20	112.65	0.58	Medium
Posttest	20	140.20		

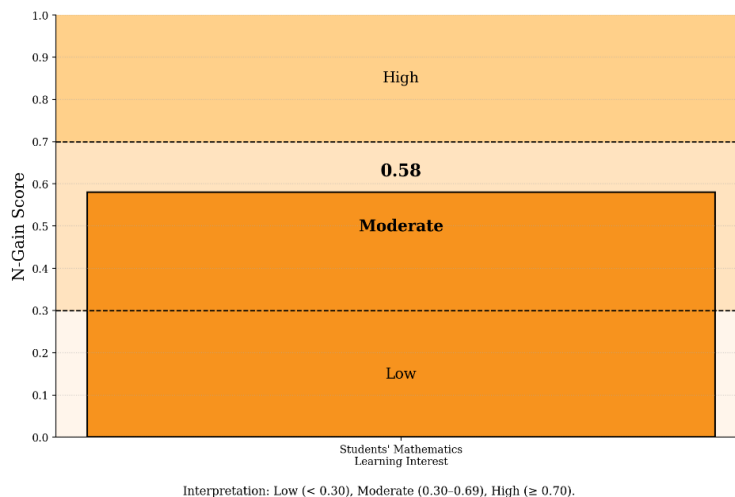
Table 5 and Figure 3 present the results of the normalized gain (N-Gain) analysis, which was conducted to evaluate the magnitude of improvement in students' interest in learning mathematics following the implementation of the interactive Quizizz paper-based learning media. As shown in Figure 3, the obtained N-Gain score was 0.58, placing it within the moderate improvement category. This finding indicates that the intervention produced a meaningful increase in students' learning interest beyond their initial level, although the improvement did not reach the high category. The moderate N-Gain score suggests that the instructional media successfully enhanced students' engagement and enthusiasm for mathematics learning while still leaving room for further improvement through continuous implementation or the integration of complementary instructional strategies.

As illustrated in Figure 3, the obtained N-Gain value is positioned between the lower threshold of the moderate category (0.30) and the lower threshold of the high category (0.70), confirming that the intervention achieved a moderate level of effectiveness. This result is consistent with the descriptive and inferential statistical analyses presented in the previous sections, which demonstrated higher posttest scores and a statistically significant improvement in students' mathematics learning interest after the intervention. Collectively, these findings indicate that the interactive Quizizz paper-based learning media provides an effective and practical instructional alternative, particularly in educational settings

where access to individual digital devices is limited. By facilitating active participation, immediate feedback, and engaging classroom interactions, the media has considerable potential to enhance students' motivation and foster greater interest in learning mathematics.

Figure 5

Distribution of the Normalized Gain (N-Gain) Score



3.2 Discussion

Based on data analysis using inferential statistics the average pretest score for student learning interest was 112.65, while the average posttest score increased to 140.20. These results indicate an increase in students' interest in learning mathematics after the implementation of the interactive Quizizz paper-based learning media. This difference indicates that the use of more interactive and activity-based learning media has a positive impact on the mathematics interest of seventh-grade students at MTsN 10 Agam.

This increase in learning interest occurs because the learning process becomes more engaging, active, and enjoyable. The use of Quizizz paper-based learning media encourages direct student involvement in the learning process through interactive quiz activities. This makes students more focused, less bored, and more motivated to participate in mathematics learning. Furthermore, learning is no longer one-way, but provides opportunities for students to actively participate, creating a more conducive and meaningful classroom atmosphere. This aligns with Leenknecht et al (2021), who found that low-stakes, interactive assessment builds motivation rather than anxiety. From a self-determination theory perspective, the group investigation and card-based response format may have supported students' basic needs for autonomy and competence, which Ryan & Deci (2000) identify as key drivers of intrinsic motivation. The repeated quiz cycles also functioned as retrieval practice, a mechanism Roediger & Karpicke (2006) associate with stronger engagement and retention than passive review.

Overall, the findings of this study indicate that the interactive Quizizz paper-based learning media can increase students' interest in learning mathematics. This condition is demonstrated by changes in student learning behavior, such as increased activeness in answering questions, increased attention to the material, and increased enjoyment during the learning process. Thus, this learning media functions not only as a learning aid but also as a means of building emotional engagement and student motivation. The immediate, item-by-item feedback built into Quizizz paper mode likely reinforced this engagement, consistent with Hattie & Timperley's (2007) finding that timely feedback is among the strongest influences on student learning.

The results of this study align with research by Widyastuti & Syahputra (2024), who concluded that the use of Quizizz paper mode can increase student interest in learning due to its interactive and

enjoyable nature. Furthermore, research by Mulyana & Rahmah (2024) also showed that the use of Quizizz paper mode has a positive and significant impact on student learning motivation. These results reinforce the finding that Quizizz-based learning media can improve students' affective aspects, particularly interest and motivation in learning. This mirrors Muchuweni et al.'s (2025) international review, which found Quizizz consistently improves student attitudes toward mathematics across diverse settings. It is worth noting, however, that broader meta-analytic evidence points to more modest average effects of gamification on motivational outcomes (Sailer & Homner, 2020), and Li et al. (2024) found gamification's impact on intrinsic motivation to be small and inconsistent across studies; the large effect observed here should therefore be interpreted with caution given the short duration and single-class sample of this study.

In terms of research implications, these results suggest that mathematics teachers need to consider using simple technology-based interactive learning media such as Quizizz paper mode in the learning process. This media can be an alternative solution for schools with limited internet access or digital devices, but still want to create innovative and engaging learning. This is consistent with broader evidence from resource-limited settings in other fields, where offline digital or hybrid approaches have been found comparably effective to conventional methods (Kyaw et al., 2019). Furthermore, the results of this study can also serve as a basis for developing more student-centered learning strategies.

The significance of this research finding is that student interest in learning can be enhanced through appropriate learning media innovation, even without complete reliance on digital technology. The paper-based Quizizz has been shown to create a more interactive, enjoyable, and meaningful learning experience, thereby helping to increase student engagement in mathematics learning. However, this study still has several limitations. First, the study was conducted in only one class with a limited sample size, thus limiting the generalizability of the results. Second, this study focused solely on the variable of interest in learning without examining other variables such as learning outcomes, critical thinking skills, or motivation in more depth. Third, the relatively short duration of the study may also affect the stability of the results of increased student interest in learning. Therefore, future research is recommended to expand the sample size, add more variables, and use a more robust experimental design to achieve more comprehensive results. Fourth, since PBL was combined with Quizizz paper mode, the interest gain cannot be attributed to Quizizz alone. Fifth, without a control group, this one-group design remains open to history, maturation, and testing effects (Campbell & Stanley, 1963). Sixth, interest was measured only through a self-report questionnaire; the observational and interview evidence noted earlier was not used in the analysis, and future studies could triangulate these sources.

Limitations

This study has several limitations. It was conducted in only one class with a limited sample size, making the results difficult to generalize. Furthermore, the study focused only on increasing students' interest in learning mathematics over a relatively short period of time, making it unable to describe the long-term impact of using the paper-based Quizizz media. This study also used only one dependent variable, namely learning interest, and therefore did not examine the media's influence on other aspects such as student learning outcomes, motivation, or mathematical thinking skills. Furthermore, external factors such as classroom conditions, student readiness, and limited learning support facilities can also influence the results.

4. Conclusion

This study demonstrates that the implementation of interactive Quizizz paper-based learning media significantly enhanced seventh-grade students' interest in learning mathematics at MTsN 10 Agam. The comparison of pretest and posttest results revealed a substantial increase in students' learning

interest following the intervention. These findings were further supported by the paired-samples t-test, which indicated a statistically significant difference between students' interest in learning mathematics before and after the treatment. Moreover, the large effect size suggests that the improvement was not only statistically significant but also educationally meaningful, highlighting the effectiveness of the Quizizz paper-based approach in creating a more engaging mathematics learning environment.

From a practical perspective, the findings indicate that integrating paper-based Quizizz into classroom instruction offers an innovative alternative for implementing interactive and technology-supported learning, particularly in schools with limited access to digital devices. By combining printed Q-Cards with the Quizizz application, teachers can provide immediate feedback, encourage active student participation, and conduct formative assessments efficiently without requiring every student to own a smartphone or computer. Consequently, this learning approach has the potential to promote greater classroom engagement, increase students' motivation, and foster a more positive attitude toward mathematics learning.

This study contributes to the growing body of literature on technology-enhanced mathematics education by demonstrating that paper-based digital learning media can effectively improve students' learning interest in resource-constrained educational settings. Nevertheless, the findings should be interpreted in light of several limitations. The study employed a one-group pretest–posttest design involving a single class in one school, which may limit the generalizability of the results. Future studies are therefore encouraged to adopt more rigorous experimental designs, include larger and more diverse samples, and investigate the long-term effects of Quizizz paper-based learning media on other educational outcomes, such as mathematical achievement, critical thinking, learning motivation, and student engagement.

Ethical Approval

This study was conducted with permission from the Principal of MTsN 10 Agam. Verbal/written consent was obtained from the classroom teacher and students prior to data collection, and participants' identities were kept confidential throughout the research process.

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Declaration of Conflicting Interests

The authors declare that there are no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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Authors' contributions

P.A. (Putri Anggun): Conceptualization, investigation, data curation, formal analysis, visualization, writing – original draft.

R. (Rusdi): Methodology, formal analysis, validation, writing – review & editing.

T.R. (Tasnim Rahmat): Validation, supervision, methodology, writing – review & editing.

N.N. (Nola Nari): Supervision, validation, project administration, writing – review & editing.

D.A.S-T (Denilson Andrés Silgado-Tuñón): Validation, supervision

Data availability

The datasets generated and analyzed during the current study, including students' mathematics learning interest questionnaires and related research data, are not publicly available due to ethical considerations and the protection of participants' privacy. However, the data are available from the corresponding author upon reasonable request.

Use of Artificial Intelligence

The authors declare that ChatGPT (OpenAI) was used solely to assist in improving the academic language, grammar, readability, and overall clarity of the manuscript. All aspects of the research, including the study design, data collection, statistical analyses, interpretation of the findings, and conclusions, are the sole intellectual responsibility of the authors. The authors carefully reviewed and verified all AI-assisted outputs and take full responsibility for the accuracy and integrity of the final manuscript.

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