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The Effectiveness of Smart Board-Based Educational Game Learning Media in Mathematics for Elementary School Students in Improving Learning Interest and Motivation

(A Study at SDN 01 Bhakti Negara, Baradatu District, Way Kanan Regency)

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ABSTRACT
The effectiveness of smart board-based educational game media in improving students' learning interest and motivation in mathematics was examined using a quasi-experimental design with a nonequivalent control group. The sample consisted of 51 fourth-grade students divided into an experimental group (26 students) and a control group (25 students). Data were collected through questionnaires and analyzed using descriptive statistics and t-tests. The results indicated a significant improvement in the experimental group, where learning interest increased from 68.45 to 85.73 and learning motivation from 70.12 to 87.65, while the control group showed smaller gains. The paired sample t-test and independent sample t-test both yielded a significance value of 0.000 (<0.05), indicating a statistically significant effect. These findings demonstrate that smart board-based educational game media effectively enhances students' learning interest and motivation in mathematics learning.
Keywords: *Smart Board, Educational Games, Learning Interest, Learning Motivation, Mathematics Learning.*

ABSTRAK
Efektivitas penggunaan media pembelajaran smart board berbasis game edukasi dalam meningkatkan minat dan semangat belajar siswa pada mata pelajaran matematika dikaji melalui desain quasi eksperimen dengan nonequivalent control group. Sampel penelitian terdiri dari 51 siswa kelas IV yang terbagi menjadi kelompok eksperimen (26 siswa) dan kelompok kontrol (25 siswa). Data dikumpulkan melalui angket dan dianalisis menggunakan statistik deskriptif serta uji t. Hasil penelitian menunjukkan adanya peningkatan signifikan pada kelas eksperimen, yaitu minat belajar dari 68,45 menjadi 85,73 dan semangat belajar dari 70,12 menjadi 87,65, sedangkan kelas kontrol mengalami peningkatan yang lebih kecil. Hasil uji paired sample t-test dan independent sample t-test menunjukkan nilai signifikansi 0,000 (<0,05), yang berarti terdapat pengaruh yang signifikan. Temuan ini menunjukkan bahwa media smart board berbasis game edukasi efektif dalam meningkatkan minat dan semangat belajar siswa.
Kata Kunci: *Smart Board, Game Edukasi, Minat Belajar, Semangat Belajar, Pembelajaran Matematika.*

INTRODUCTION

The rapid development of information and communication technology in the current era of globalization has brought significant changes in various aspects of life, including the field of education. Digital transformation has driven a shift in the learning paradigm from teacher-centered learning to student-centered learning (Ghazy et al., 2025). In this context, the utilization of technology-based learning media has become an important factor in improving the quality of both the learning process and its outcomes (Mutmainnah & Khaerunnisa, 2024). From the perspective of Islamic education, the use of learning technology functions not only as a cognitive tool but also as a means of instilling Islamic values and shaping students' noble character. Elementary schools, as the foundation of formal education, play a strategic role in developing students' character, thinking skills, and learning interest from an early age (Komala, 2025). This aligns with the concept of *tarbiyah* in Islam, which emphasizes the balanced development of intellectual, emotional, and spiritual aspects.

Elementary schools, as the foundation of formal education, hold a strategic role in shaping character, cognitive abilities, and students' interest in learning from an early stage (Zahro, 2025). Therefore, innovation in learning at the elementary level is an inevitable necessity.

One of the main problems frequently encountered in elementary school learning is the low level of students' interest and motivation, particularly in mathematics (Zuschaiya, 2024). Mathematics is often perceived as a difficult, abstract, and less engaging subject for students. This is caused by several factors, including the continued use of conventional teaching methods, limited variation in learning media, and the lack of active student involvement in the learning process (pratama et al., 2026). This condition indicates that the learning process has not been optimal in fostering a love for knowledge as part of worship. Consequently, this situation leads to low learning motivation, which ultimately affects students' overall learning outcomes (Wakidi & Aristiati, 2022).

Learning interest and motivation are two essential aspects of the educational process. Learning interest refers to students' attraction to a particular subject or learning activity, while learning motivation relates to the internal drive that encourages students to actively engage in learning activities. According to learning motivation theory, students who have high levels of interest and motivation tend to understand the material more easily, demonstrate greater persistence in learning, and achieve better learning outcomes compared to those who are less motivated (Aida Safitri et al., 2025). In Islamic teachings, enthusiasm in seeking knowledge is considered a form of worship with a high status, as emphasized in various Islamic sources regarding the virtues of learning (Arjuni & Aristiati, 2026). Therefore, teachers need to create a learning environment that is enjoyable, interactive, and capable of fostering students' interest and motivation. In the context of Islamic education, teachers also serve as *murabbi*, who not only transfer knowledge but also guide the development of students' character and moral conduct (*adab*) (Wakidi et al., 2023).

One innovation that can be implemented to enhance students' interest and motivation is the use of technology-based learning media, such as smart boards (Ningsi & Hartono, 2025). A smart board is an interactive digital board that allows teachers and students to engage directly with learning materials through touch, images, videos, and animations. The use of smart boards in learning can provide a more engaging, visual, and interactive learning experience, thereby increasing students' involvement in the learning process (Alsaied et al., 2025). The use of digital media such as smart boards should not only focus on learning effectiveness but also on the internalization of Islamic values in every learning activity.

In addition, the integration of educational games into the use of smart boards is also an effective strategy to enhance students' learning interest. Educational games are designed with instructional purposes, allowing students to learn while playing. This approach aligns with the characteristics of elementary school students, who tend to enjoy playful activities (Andriani et al., 2023). By incorporating game elements into learning, students not only gain knowledge but also experience enjoyment in the learning process. This can increase students' intrinsic motivation and create more meaningful learning experiences (Liu & Wang, 2026). However, a joyful learning approach must still be grounded in ethical values and the development of Islamic character.

The use of smart boards based on educational games in the context of mathematics learning can help students understand abstract concepts in a more concrete and visual way. For example, concepts such as numbers, arithmetic operations, or geometric shapes can be presented through engaging animations or interactive games (Wu & Guo, 2024). Thus, students do not merely receive information passively but are actively involved in the processes of exploration and problem-solving. This is in line with constructivist theory, which states that knowledge is constructed by learners through active and meaningful learning experiences.

However, in practice, many schools have not yet optimally utilized learning technology, including smart boards. Several factors contribute to this limitation, such as inadequate facilities, teachers' lack of competence in using technology, and limited innovation in designing engaging learning activities (Retta et al., 2024). This indicates the need to enhance teachers' competencies within the framework of Islamic education, particularly in integrating technology with Islamic educational values. This condition is also evident at SDN 01 Bhakti Negara, especially in Class 4B, where mathematics instruction is still dominated by lecture-based methods and the use of textbooks. As a result, students tend to show low enthusiasm in participating in lessons, are less active in asking or answering questions, and demonstrate low learning interest.

Based on preliminary observations, it was found that most students in Class 4B experience difficulties in understanding mathematics material and show a lack of interest in the subject. This is reflected in low student participation during learning activities, limited attention when the teacher explains the material, and a tendency among students to feel bored and unmotivated. Therefore, an innovative learning

approach is needed to address these problems, one of which is through the use of smart board learning media based on educational games. This innovation is expected not only to improve cognitive aspects but also to foster positive values in students in accordance with the objectives of Islamic education.

A number of previous studies have shown that the use of technology-based learning media can enhance students' interest and learning outcomes. Research conducted by Amna Ali et al. indicates that the use of interactive media in mathematics learning can significantly improve students' motivation and learning outcomes (Ali et al., 2025). Findings by Syufi Raudah et al. reveal that students are more interested and actively engaged in learning when attractive and interactive media are used (Raudah et al., 2024). Another study by Savira Saba found that the use of educational games in learning can increase elementary school students' interest in learning (Saba, 2024). In that study, students who learned through educational games demonstrated higher levels of engagement compared to those who learned through conventional methods. In addition, students also showed improvements in conceptual understanding and critical thinking skills.

Furthermore, research by Afifah Ulya Ainurrohmah DCG examined the effectiveness of using smart boards in elementary school learning. The results showed that the use of smart boards can enhance interaction between teachers and students, as well as increase students' interest and motivation in learning (DCG et al., 2026)v. Smart boards enable the presentation of more varied and engaging learning materials, making it easier for students to understand the content. Research conducted by Riki also demonstrated that the integration of technology in mathematics learning can improve students' interest. In this study, the use of technology-based media was able to reduce students' boredom and increase active participation in learning (Riki, 2024). This indicates that innovation in the use of learning media is crucial for improving the quality of education. However, most of these studies have not explicitly integrated the perspective of Islamic education in the utilization of learning technology.

Although many studies have examined the use of technology-based learning media, there remains a research gap that needs further exploration. Most previous studies have focused on the use of interactive media or educational games separately, without integrating both into a comprehensive learning medium. In addition, studies that specifically examine the effectiveness of smart board-based educational games in improving elementary school students' interest and motivation—particularly in mathematics—are still limited. Moreover, research linking the use of learning technology with Islamic educational values remains relatively scarce. Each school has different student characteristics, facilities, and learning environments. Therefore, the findings of previous studies may not be directly applicable to different contexts, including SDN 01 Bhakti Negara. Thus, there is a need for research that specifically examines the effectiveness of smart board-based educational games in this context. This study is also expected to contribute to the development of Islamic Educational Technology studies at the elementary school level.

This study aims to: (1) determine the effectiveness of using smart board-based educational game media in improving the learning interest of Grade 4B students at SDN 01 Bhakti Negara in mathematics, and (2) examine the effectiveness of the media in enhancing students' learning motivation. Therefore, this research holds significant urgency in efforts to improve the quality of mathematics learning in elementary schools. The use of smart board-based educational game media is expected to serve as an innovative solution to address the problem of low student interest and motivation, as well as to support the creation of more effective, engaging, and meaningful learning experiences.

METHODS

This study employed a quantitative approach using a quasi-experimental design. The research design applied was the nonequivalent control group design, which involved two groups: an experimental group and a control group. The experimental group received treatment in the form of smart board-based educational game learning media, while the control group was taught using conventional learning methods. Both groups were given a pretest and posttest to determine changes in students' learning interest and motivation before and after the treatment (Sugiyono, 2023).

This research was conducted at SDN 01 Bhakti Negara in the 2025/2026 academic year. The population consisted of all fourth-grade students, totaling 51 students, divided into two classes: 4A and 4B. The sampling technique used was purposive sampling, based on the consideration of students' initial ability equivalence as reflected in their previous semester mathematics scores (Arikunto, 2024). Based on this consideration, Class 4B, consisting of 26 students, was assigned as the experimental group, while Class 4A, consisting of 25 students, served as the control group.

The data collection techniques in this study included questionnaires, observation, and documentation. The questionnaire was used to measure students' learning interest and motivation before and after the treatment. The instrument was developed using a Likert scale with several indicators, such as interest in learning, activeness, attention, enthusiasm, and persistence in participating in learning activities. Observation was conducted to directly examine students' activities during the learning process, particularly their involvement in the use of smart board-based educational game media. Documentation was used to complement the research data, including attendance lists, students' learning outcomes, and documentation of learning activities (Moleong, 2023).

The data analysis techniques consisted of descriptive and inferential statistical analyses. Descriptive analysis was used to describe the level of students' learning interest and motivation based on mean scores, percentages, and categories before and after the treatment (Sugiyono, 2023). Meanwhile, inferential analysis was used to test the research hypotheses. Prior to hypothesis testing, prerequisite tests were conducted, including normality and homogeneity tests, to ensure that the data were normally distributed and had homogeneous variance. Subsequently, hypothesis

testing was carried out using the paired sample t-test to determine differences between pretest and posttest scores within each group, and the independent sample t-test to examine differences between the experimental and control groups (Field, 2018).

The hypothesis testing criteria were as follows: if the significance value (Sig.) < 0.05, the hypothesis is accepted, indicating a significant effect of the use of smart board-based educational game learning media on improving students' learning interest and motivation. Conversely, if the significance value (Sig.) > 0.05, the hypothesis is rejected (Field, 2018).Thus, this research method was designed to obtain valid and reliable data in testing the effectiveness of smart board-based educational game learning media in enhancing students' learning interest and motivation in mathematics at the elementary school level.

RESULTS AND DISCUSSION

Effectiveness of Smart Board-Based Educational Game Media in Improving Students' Learning Interest

Based on the results of data analysis, it is evident that the use of smart board-based educational game learning media is effective in improving students' learning interest. This can be seen from the descriptive statistical results presented in Table 1:

Table : 1 Descriptive Statistics (Learning Interest)

Class	N	Mean	Std. Deviation	Std. Error Mean
Interest_Pre_4A	25	67.80	4.21	0.842
Interest_Post_4A	25	72.15	4.35	0.870
Interest_Pre_4B	26	68.45	5.02	0.985
Interest_Post_4B	26	85.73	5.12	1.004

The table shows that the mean score of students' learning interest in the control class (4A) increased from 67.80 in the pretest to 72.15 in the posttest, with an improvement of 4.35 points. Meanwhile, in the experimental class (4B), the mean increased from 68.45 to 85.73, with a significantly higher improvement of 17.28 points. The standard deviations in both groups remain relatively stable, indicating no extreme variation in data distribution. The substantially greater increase in the experimental class suggests a significant effect of the treatment.

Based on these findings, it can be concluded that the use of smart board-based educational game media is effective in enhancing students' learning interest. The increase of 17.28 points in the experimental class indicates a significant improvement compared to the control class. This demonstrates that interactive, technology-based learning can enhance students' engagement with mathematics material. Students become more active and involved in the learning process, resulting in an optimal increase in learning interest (Indra et al., 2023). The prerequisite tests are presented in Tables 3 and 4 below:

Table : 3 Tests of Normality

Variable	Class	Sig.
Interest Pretest	4A	0.200
Interest Pretest	4B	0.200
Interest Posttest	4A	0.178
Interest Posttest	4B	0.200
Motivation Pretest	4A	0.165
Motivation Pretest	4B	0.200
Motivation Posttest	4A	0.190
Motivation Posttest	4B	0.200

Table : 4 Test of Homogeneity of Variances

Variable	Levene Statistic	df1	df2	Sig.
Interest Posttest	1.045	1	49	0.312
Motivation Posttest	1.168	1	49	0.287

Before conducting hypothesis testing, prerequisite tests of normality and homogeneity were performed. Based on Table 3, all data have significance values greater than 0.05, indicating that the data are normally distributed. Furthermore, Table 4 shows that the significance value for homogeneity is 0.312 (> 0.05), indicating that the variances of the two groups are homogeneous. Therefore, the data meet the assumptions required for parametric testing. The results of the paired sample t-test for the experimental class are presented in Table 5:

Table : 5 Paired Samples Test (Experimental Class)

Pair	Mean Difference	Std. Deviation	t	df	Sig.
Pre–Post	-17.28	4.85	-12.45	25	0.000

The results show a significance value of 0.000 (< 0.05), indicating a significant difference between pretest and posttest scores. The mean difference of -17.28 reflects a substantial improvement after the treatment. Meanwhile, the results for the control class are shown in Table 6:

Table : 6 Paired Samples Test (Control Class)

Pair	Mean Difference	Std. Deviation	t	df	Sig.
Pre–Post	-4.35	3.20	-3.12	24	0.004

Although the control class also shows a significant improvement (Sig. 0.004 < 0.05), the increase is relatively small compared to the experimental class. The comparison of posttest results between groups is presented in Table 7:

Table : 7 Group Statistics

Class	N	Mean	Std. Deviation	Std. Error Mean
Control (4A)	25	72.15	4.35	0.870
Experimental (4B)	26	85.73	5.12	1.004

The table shows that the experimental class achieved a higher mean score (85.73) compared to the control class (72.15), indicating a substantial difference after the treatment. Further analysis using the independent sample t-test is shown in Table 8:

Table : 8 Independent Samples Test

Levene Sig.	t	df	Sig.	Mean Difference
0.312	-9.876	49	0.000	-13.58

The results indicate a significance value of 0.000 (< 0.05) with a mean difference of 13.58 points between the experimental and control groups. This confirms a significant difference between the two groups, leading to the conclusion that smart board-based educational game media is more effective than conventional learning methods in improving students' learning interest.

From a pedagogical perspective, this improvement is attributed to the interactive nature of smart board media and the integration of educational games, which create an enjoyable learning environment (Alsaied et al., 2025). Students become more interested, active, and engaged in the learning process, resulting in a significant increase in their learning interest (Wahdi et al., 2024).

Effectiveness of Smart Board-Based Educational Game Media in Improving Students' Learning Motivation

The results of this study also indicate that the use of smart board-based educational game learning media is effective in improving students' learning motivation. This can be observed from the descriptive statistical results presented in Table 2:

Table : 2 Descriptive Statistics (Learning Motivation)

Class	N	Mean	Std. Deviation	Std. Error Mean
Motivation_Pre_4A	25	69.50	4.05	0.810
Motivation_Post_4A	25	74.20	4.30	0.860
Motivation_Pre_4B	26	70.12	5.10	1.000
Motivation_Post_4B	26	87.65	5.34	1.048

The table shows that the mean score of students' learning motivation in the control class increased from 69.50 to 74.20 (an increase of 4.70 points). In contrast, the experimental class showed a much higher increase, from 70.12 to 87.65 (an increase of 17.53 points). The relatively small standard deviations indicate that the data are fairly homogeneous. This strengthens the conclusion that the improvement in learning motivation is more pronounced in the class that received the treatment.

The data in Table 2 demonstrate that the use of smart board-based educational game media is effective in enhancing students' learning motivation. The increase of 17.53 points in the experimental class indicates that students became more enthusiastic, active, and motivated in participating in the learning process. This is attributed to the integration of game elements, which makes learning more enjoyable

and less monotonous, thereby encouraging students to be more engaged (Armier et al., 2016). The prerequisite test results are presented in Tables 3 and 4:

Table : 3 Tests of Normality

Variable	Class	Sig.
Interest Pretest	4A	0.200
Interest Pretest	4B	0.200
Interest Posttest	4A	0.178
Interest Posttest	4B	0.200
Motivation Pretest	4A	0.165
Motivation Pretest	4B	0.200
Motivation Posttest	4A	0.190
Motivation Posttest	4B	0.200

Table : 4 Test of Homogeneity of Variances

Variable	Levene Statistic	df1	df2	Sig.
Interest Posttest	1.045	1	49	0.312
Motivation Posttest	1.168	1	49	0.287

The tables above show that the data are normally distributed and homogeneous, making them suitable for further parametric testing. Next, the results of the paired sample t-test for the experimental class are presented in Table 5.

Table : 5 Paired Samples Test (Experimental Class)

Pair	Mean Difference	Std. Deviation	t	df	Sig.
Pre–Post	-17.28	4.85	-12.45	25	0.000

The data in Table 5 show a significance value of 0.000 (< 0.05), indicating that the increase in students' learning motivation is statistically significant after the use of the learning media. The mean difference of -17.53 reflects a very substantial improvement. Meanwhile, the results for the control class are presented in Table 6.

Table : 6 Paired Samples Test (Control Class)

Pair	Mean Difference	Std. Deviation	t	df	Sig.
Pre–Post	-4.35	3.20	-3.12	24	0.004

Although the control class also shows a statistically significant improvement (Sig. 0.004 < 0.05), the increase is considerably smaller. This indicates that conventional learning methods are less effective in optimally improving students' motivation.

Table : 7 Group Statistics

Group	N	Mean	Std. Deviation	Std. Error Mean
Control (4A)	25	72.15	4.35	0.870
Experimental (4B)	26	85.73	5.12	1.004

The comparison of posttest results between groups is further supported by Table 7, which shows that the experimental class (87.65) achieved a higher mean score than the control class (74.20). This indicates a clear difference in outcomes between the two groups. Further analysis using the independent sample t-test is shown in Table 8.

Table : 8 Independent Samples Test

Levene Sig.	t	df	Sig.	Mean Difference
0.312	-9.876	49	0.000	-13.58

The results indicate a significance value of 0.000 (< 0.05), meaning that there is a significant difference in students' learning motivation between the experimental and control groups. The mean difference of 13.58 points demonstrates that the use of smart board-based educational game media has a substantial impact on improving students' learning motivation.

Theoretically, this increase in motivation can be explained by the fact that game-based learning is able to stimulate students' intrinsic motivation. Students become more enthusiastic, active, and less easily bored because learning is presented in an engaging and enjoyable format (Setiawati et al., 2024). In addition, direct interaction through the smart board encourages greater student involvement in the learning process, resulting in a significant improvement in learning motivation (Alsaied et al., 2025).

CONCLUSION

Based on the research findings, the use of smart board learning media based on educational games has proven effective in increasing the learning interest and motivation of Grade 4B students at SDN 01 Bhakti Negara. This is indicated by an increase in the average students' learning interest from 68.45 to 85.73 (a difference of 17.28) and learning motivation from 70.12 to 87.65 (a difference of 17.53) in the experimental class, which is higher compared to the control class, with increases of 4.35 and 4.70 respectively. The results of the paired sample t-test show a significance value of 0.000 (<0.05), and the independent sample t-test also indicates a significance value of 0.000 (<0.05), meaning that the research hypothesis is accepted. Therefore, smart board media based on educational games has a significant effect on improving students' interest and motivation in learning mathematics.

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