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ALGEBRAVID: Interactive Video Media as an Innovation in Algebra Learning to Improve Student Learning Outcomes

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Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh penggunaan media pembelajaran interaktif berbasis PowerPoint ALGEBRAVID terhadap hasil belajar matematika siswa pada materi operasi aljabar dua variabel. Penelitian ini menggunakan metode kuantitatif dengan Desain Satu Kelompok Pretest–Posttest. Subjek penelitian terdiri dari 20 siswa kelas tujuh. Instrumen penelitian berupa tes hasil belajar yang diberikan sebelum dan sesudah perlakuan. Perlakuan dilakukan melalui pembelajaran menggunakan media PowerPoint interaktif yang dilengkapi dengan animasi, video pembelajaran, permainan edukatif, dan fitur interaktif untuk meningkatkan keterlibatan siswa. Hasil penelitian menunjukkan bahwa rata-rata nilai siswa meningkat dari 54,05 pada pretest menjadi 61,597 pada posttest. Hasil uji t sampel berpasangan menunjukkan nilai signifikansi 0,000 (p <0,05), yang berarti terdapat pengaruh signifikan terhadap hasil belajar setelah menggunakan media pembelajaran. Selain itu, hasil perhitungan N-gain berada pada kategori rendah, yang menunjukkan bahwa media pembelajaran cukup efektif dalam meningkatkan hasil belajar siswa. Dengan demikian, media pembelajaran ALGEBRAVID dapat menjadi inovasi alternatif dalam pembelajaran matematika interaktif dan mampu meningkatkan pemahaman konseptual siswa.

Abstract

This study aims to determine the effect of using ALGEBRAVID interactive PowerPoint-based learning media on students' mathematics learning outcomes in the material of two-variable algebraic operations. The study used a quantitative method with a Pretest–Posttest One Group Design. The research subjects consisted of 20 seventh-grade students. The research instrument was a learning outcome test given before and after treatment. The treatment was carried out through learning using interactive PowerPoint media equipped with animations, learning videos, educational games, and interactive features to increase student engagement. The results showed that the average student score increased from 54.05 in the pretest to 61.597 in the posttest. The results of the paired sample t-test showed a significant value of 0.000 (p <0.05), which means there is a significant effect on learning outcomes after using the learning media. In addition, the results of the N-gain calculation are in the low category, which indicates that the learning media is quite effective in improving student learning outcomes. Thus, ALGEBRAVID learning media can be an alternative innovation in interactive mathematics learning and is able to improve students' conceptual understanding.

INTRODUCTION

Mathematics is a fundamental subject in education that plays a crucial role in developing students' logical, analytical, systematic, critical, and creative thinking skills. Strong mathematical skills are also a crucial indicator of an individual's readiness to face the development of science and technology in the digital age. However, the reality on the ground shows that students' mathematics learning outcomes in Indonesia are still relatively low and have not yet achieved the expected competencies. The results of the 2022 Programme for International Student Assessment (PISA) showed that the average mathematics score of Indonesian students was 366, far below the average for member countries of the Organisation for Economic Co-operation and Development (OECD) of around 472 (Fahira & Yulia, 2025).

The problem of low mathematics learning outcomes is also evident at the junior high school level (SMP) at SMPN 18 Padang, particularly in algebra. Algebra is a basic subject with a

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high level of abstraction because it involves symbols, variables, and mathematical operations that require strong representation and reasoning skills (Oktavia & Yulia, 2025). Many students struggle to grasp algebraic concepts because the learning they receive is procedural and lacks meaningful learning experiences. Teacher-centered learning tends to cause students to become passive, less actively involved, and simply memorize problem-solving steps without a deep understanding of the concepts. As a result, students often make mistakes in solving algebra problems, resulting in low learning outcomes.

In addition to learning approaches, the lack of varied learning media also contributes to low student understanding. Learning media plays a crucial role in helping students understand abstract concepts more concretely through clearer visualizations and representations (Yulia & Nasution, 2024). However, in practice, many teachers still use conventional methods with limited media, such as blackboards or textbooks, resulting in less engaging learning and less able to accommodate students' diverse learning styles. This condition results in low student motivation and less than optimal student engagement in the mathematics learning process (Yulia et al., 2026).

Along with the development of information and communication technology, the use of digital-based learning media has become a potential solution to improve the quality of mathematics learning. Learning video media is a form of multimedia that can combine visual elements, audio, animation, and text, thereby increasing student attention and understanding (Bito & Masaong, 2023). Previous research has shown that the use of video media can improve learning motivation, conceptual understanding, and student learning outcomes (Fazila & Khatimah, 2024). However, most learning video media used is still passive or one-way (non-interactive), so students only act as recipients of information without actively participating in the learning process. However, active student involvement is a crucial factor in improving conceptual understanding and learning outcomes (Yulia et al., 2021).

Mathematics learning at the junior high school level demands innovative media that can help students understand concepts more concretely, especially in algebra, which is often considered abstract and difficult by students (NCTM, 2020). Studies show that learning that does not involve interactive media often makes students less active, less motivated, and has difficulty understanding algebraic operations (Siregar & Surya, 2019). This condition aligns with the finding that traditional lecture methods are less effective for mathematics materials that require symbolic understanding and visual representation (Widodo & Kartikasari, 2017).

Furthermore, research on the use of interactive video media in mathematics learning, particularly in junior high school algebra, is still relatively limited. Some existing studies focus more on the influence of video media on learning motivation or general conceptual understanding, but not many integrate elements of interactivity, visualization of algebraic concepts, problem-solving-based exercises, and a student-centered learning approach into a single integrated learning medium. This condition indicates that the development of interactive video-based learning media specifically designed to improve junior high school students' algebra learning outcomes through a more comprehensive and integrated approach is not yet optimal. Various previous studies have shown that the use of interactive digital media can improve students' understanding of mathematical concepts and motivation. For example, learning videos have been shown to be effective in improving understanding of algebraic concepts (Putri & Yunianta, 2021) interactive PPTs can increase student participation (Rahmawati & Firmansyah, 2020), and game-based quizzes can increase positive responses and learning outcomes (Harsyad, 2022). However, most of these studies have focused on the use of only one type of media, so the integration of multiple learning features within a single integrated medium has not been widely studied.

Based on these problems, innovative learning media are needed that can integrate digital technology with the needs of effective and engaging mathematics learning. One innovation that can be developed is the ALGEBRAVID learning media, an interactive video media designed to help students understand algebraic concepts through visualization, animation, step-by-step explanations, and interactive activities that involve active student participation. This media not only presents material audiovisually, but also provides opportunities for students to interact through practice questions, direct feedback, and contextual problem-solving simulations. Thus,

students do not only receive information passively, but are also actively involved in the learning process, which is expected to improve conceptual understanding and learning outcomes.

This study applies interactive video media that integrates several learning components into one integrated medium, namely visualization of abstract algebraic concepts, student-based interactivity, gradual conceptual exercises, and a student-centered learning approach. ALGEBRAVID media is specifically designed for the characteristics of junior high school algebra material so that it has advantages compared to conventional learning video media which generally only present material informatively without active student involvement. In addition, this study also emphasizes improving learning outcomes as the main indicator of the effectiveness of learning media, thus providing an empirical contribution to the development of digital technology-based mathematics learning innovations.

Based on the description above, the purpose of this study is to determine the effectiveness of using ALGEBRAVID interactive video media as an innovation in algebra learning in improving student learning outcomes. Furthermore, this study also aims to analyze the improvement in students' conceptual understanding after the application of ALGEBRAVID media in the mathematics learning process. The results of this study are expected to contribute to the development of innovative learning media and become an alternative solution in improving the quality of mathematics learning in junior high schools.

METHOD

This study employed a quantitative method with a One Group Pretest–Posttest design. This design was chosen to determine the effect of using the ALGEBRAVID learning media on improving student learning outcomes. In this design, students were first given a pretest, then received treatment in the form of learning using the ALGEBRAVID media, and at the end of the activity, a final test (posttest) was administered. Thus, a comparison of scores before and after treatment can illustrate the improvement in learning outcomes.

The study population was all seventh-grade students at SMPN 18 Padang, while a sample of 20 students was selected using a purposive sampling technique, based on the consideration that the class was suitable for the algebra material and they were willing to participate in the research process for one full session. The research instruments consisted of a learning outcome test consisting of five essay questions that measured algebraic addition and multiplication skills, a Wordwall quiz as formative evaluation, a Likert-scale student response questionnaire to determine responses to the media, and an activity observation sheet as supporting data during the learning process.

The research procedure began with the preparation stage, which involved developing the ALGEBRAVID media, consisting of interactive PPT, learning videos, and Wordwall quizzes. The pretest, posttest, and questionnaire response instruments were validated by expert lecturers. Next, in the implementation stage, which took place over a single day, the teacher administered a pretest, presented algebra material using the ALGEBRAVID media, continued with a Wordwall quiz, and then administered a posttest to assess learning outcomes. Afterward, students completed a questionnaire responding to the media. All data obtained from the pretest, posttest, quizzes, and questionnaires were collected in the next stage and analyzed using descriptive and inferential statistics.

Analysis of learning outcomes was conducted using a paired-sample t-test and N-Gain to assess the effectiveness of the media in improving student scores. If Sig. <0.05, H0 is rejected and Ha is accepted. This indicates a significant difference between before and after (effective treatment). Meanwhile, N-Gain results were categorized as high (≥ 0.70), moderate (0.30–0.69), and low (< 0.30). Student response data was analyzed using percentages, with interpretations categorized as very good (81–100%), good (61–80%), sufficient (41–60%), and poor (≤ 40%). Indicators of research success were determined through several criteria: a significant increase in learning outcomes, a minimum N-Gain score in the moderate category (≥ 0.30), a posttest average higher than the pretest, and at least 75% of students achieving the Minimum Competency (KKM).

Furthermore, the research was declared successful if student responses to the ALGEBRAVID media were positive, with questionnaire scores at least in the good category (≥ 61%).

RESULT AND DISCUSSION

Result

The research began with the development of an interactive PowerPoint-based learning media named ALGEBRAVID. This media is designed to support the learning of two-variable algebraic operations, including addition, subtraction, multiplication, and division. The media development was carried out by utilizing various interactive features such as animation, hyperlinks, and triggers, allowing students to interact directly with the learning material. In addition, the media is also equipped with a video explaining the concept to help students understand the material gradually. The visual design is made attractive through the use of animated characters, mathematical icons, dynamic symbol displays, and educational game elements, as can be seen in Figure 1 below:



Figure 1. Learning video on ALGEBRAVID.

The media also includes a math adventure game and a spin wheel feature that can be played individually to increase student engagement in learning. The interactive and fun characteristics of this media are expected to increase learning motivation and facilitate understanding of abstract algebraic concepts. The game used can be seen in Figure 2 below:

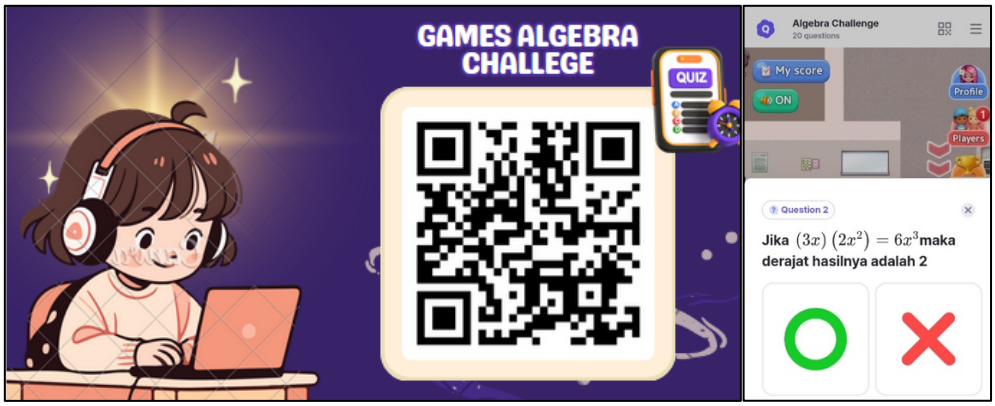


Figure 2. shows the ALGEBRAVID game.

Learning activities consist of three main stages, namely: Pretest, Students are given an initial test to measure basic abilities before using ALGEBRAVID media. The pretest results are obtained from subject teachers. Implementation, Learning is carried out using ALGEBRAVID

media. The teacher first explains the concept of the material through interactive media, then students are actively involved in answering questions through games available in the media. This activity aims to increase learning motivation while measuring student understanding directly. Posttest, After the learning is completed, students are given a final test with a level of difficulty equivalent to the pretest to determine the improvement in learning outcomes after using the media. The results of the descriptive analysis can be seen in table 1 below.

Table 1. Results of descriptive analysis

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Sebelum	54.0500	20	23.31359	5.21308
	Sesudah	61.5970	20	27.26583	6.09682

Based on the research results in Table 1 above, The results of the descriptive analysis showed that the average student learning outcome score before the treatment (pretest) was 54.05 with a standard deviation of 23.31. After being given treatment using the ALGEBRAVID media, the average student learning outcome score increased to 61.60 with a standard deviation of 27.27. This represents an average increase of 7.55 points, or approximately 13.96%, from the initial level.

This increase in the average score indicates a change in student ability after participating in the learning using the ALGEBRAVID media. However, the relatively large standard deviation indicates significant variation in student ability, both before and after the treatment. This indicates that students' initial abilities are heterogeneous, and therefore, the improvement that occurs also varies across students. To determine the significance of the improvement in learning outcomes, a paired sample t-test was conducted between pretest and posttest scores. The results can be seen in Table 2 below:

Table 2. Result of paired sample t-test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Sebelum - Sesudah	-7.54700	5.94184	1.32864	-10.32787	-4.76613	-5.680	19	.000

The analysis results in Table 2 above show a t-value of -5.680 with 19 degrees of freedom (df) and a 2-tailed significance level of 0.000. Because the significance level is less than 0.05, H_0 is rejected and H_a is accepted. Therefore, it can be concluded that there is a significant difference between learning outcomes before and after using the ALGEBRAVID learning media. Furthermore, the 95% confidence interval for the mean difference ranges from -10.33 to -4.77. This range does not cross zero, further confirming that the difference is statistically significant. Considering the effect size, Cohen's d can be calculated by dividing the mean difference by the standard deviation of the difference (7.547 / 5.942), resulting in a value of approximately 1.27. This value is included in the large effect size category, which shows that the use of ALGEBRAVID media has a strong influence on improving student learning outcomes.

To determine the significance of the improvement in learning outcomes, a paired sample t-test was conducted. The analysis results showed a significance value (Sig. 2-tailed) of 0.000 < 0.05, with a calculated t-value of -5.680 at 19 degrees of freedom (df). Based on the decision-making criteria, because the significance value is less than 0.05, H_0 is rejected and H_a is accepted,

indicating a significant difference between learning outcomes before and after using the ALGEBRAVID media. Thus, the use of the ALGEBRAVID learning media has been proven to have a significant impact on improving student learning outcomes.

Analysis of student learning outcomes was also conducted using the N-Gain test to determine the effectiveness of the ALGEBRAVID learning media. Based on the calculations, the average pretest score was 54.05 and the average posttest score was 61.597. The N-Gain calculation results showed a value of 0.16, which is included in the low category.

Discussion

The results of the study indicate that the use of ALGEBRAVID learning media has a positive influence on student learning outcomes in the material of two-variable algebraic operations. This is indicated by an increase in students' average score from 54.05 in the pretest to 61.597 in the posttest with a difference of 7.547 points. This increase is reinforced by the results of the paired sample t-test which shows a significance value of 0.000 <0.05, so it can be concluded that there is a significant difference between learning outcomes before and after the use of ALGEBRAVID learning media. Thus, statistically the learning media used is proven to be effective in improving student learning outcomes.

However, the N-Gain analysis results showed a value of 0.16, which is in the low category. The discrepancy between a high significance test result and a low N-Gain value is a common phenomenon in educational research, particularly in studies with relatively short treatment durations. The t-test indicates a statistically significant change, while the N-Gain measures the level of effectiveness of the improvement relative to the maximum score. In this study, the treatment so the improvement was not optimal enough to reach the moderate or high effectiveness category. Therefore, the low N-Gain result does not indicate that the media is ineffective, but rather indicates that improvement can be further enhanced with continued use.

The improvement in learning outcomes in this study is inseparable from the characteristics of the ALGEBRAVID media, which is designed based on interactive multimedia (Ahmed Dahri et al., 2025). This media integrates visual elements, audio, animation, and interactive activities in the form of educational games, thereby increasing student engagement in learning (Triantafyllou et al., 2025). Abstract algebraic material becomes more concrete through symbol visualizations, problem-solving steps, and step-by-step explanations in video format (Lepak et al., 2018). These visualizations help students build conceptual understanding, thereby reducing errors in performing algebraic operations.

Furthermore, interactive features such as math adventure games and spinner wheels provide a fun yet challenging learning experience for students. These game activities encourage students to actively engage in the learning process, increase motivation, and create a more engaging learning environment than conventional learning. Active student engagement is a crucial factor in improving learning outcomes because students not only passively receive information but also participate in the process of constructing knowledge independently (Yulia et al., 2026).

Theoretically, the findings of this study align with multimedia learning theory, which states that the combination of visual and verbal information can improve student understanding and retention. Media that engages more than one sense allows students to process information more deeply, thus helping to form stronger knowledge schemas (Bito & Masaong, 2023). Furthermore, constructivism theory also supports the notion that learning will be more meaningful when students are actively involved in the process of discovering knowledge through learning activities (Yulia & Lova, 2025). The results of this study also reinforce previous research findings that the use of digital technology-based learning media can improve students' motivation and mathematics learning outcomes (Balbi et al., 2024). However, this study has advantages over previous research because ALGEBRAVID is not simply a traditional learning video, but rather an integrated medium that combines interactive PowerPoint, learning videos, and educational games

within a single learning system. The integration of these learning components creates a novelty value that contributes to the development of innovative mathematics learning media.

Although the study showed positive results, several factors contributed to the suboptimal level of learning outcomes. First, the research treatment was conducted in only one session, resulting in limited practice time for students. Second, the heterogeneity of students' initial abilities led to varying levels of improvement across students. Third, the use of new learning media requires an adaptation process, so students are not yet fully accustomed to utilizing the media to its full potential. These factors likely contributed to the low N-Gain score.
However, the statistical test results, which showed a significant effect and an increase in average scores, indicate that the ALGEBRAVID media has good potential to improve learning outcomes if used continuously in the learning process. With more intensive and repeated use, student learning outcomes are expected to reach a higher level of effectiveness.

The implications of this study indicate that the use of interactive multimedia-based learning media can be an alternative solution to improve the quality of mathematics learning, particularly in the abstract subject of algebra. The ALGEBRAVID media can assist teachers in creating more engaging, interactive, and student-centered learning, thereby increasing student motivation and learning outcomes. Therefore, this media has the potential to be further developed and applied to other mathematics materials. Overall, the research results indicate that the ALGEBRAVID learning media is effective in improving student learning outcomes, as evidenced by the increase in average scores, significant differences based on paired sample t-tests, and positive student responses to the media's use. Therefore, the ALGEBRAVID media can be a relevant learning innovation to support mathematics learning in schools.

CONCLUSION

Based on the results of the research data analysis, it can be concluded that there is a significant difference between student learning outcomes before and after the implementation of the learning treatment. The average value before the treatment was 54.05, increasing to 61.60 after the treatment was given. The results of the peered sample t-test showed a significance value of 0.000 ($p < 0.05$), so it can be stated that the applied learning treatment had a significant effect on improving student learning outcomes. In addition, the results of the N-gain calculation were in the low category, which indicates that the applied learning was quite effective in improving student understanding, although the increase had not yet reached the high category. This improvement in learning outcomes indicates that the learning strategies used provided a more meaningful learning experience, increased student engagement, and helped them understand the material better than before the intervention. Therefore, the treatment can be used as an alternative to improve the quality of the learning process and outcomes.

Based on the research findings, it is recommended that mathematics teachers utilize interactive video-based learning media such as ALGEBRAVID as an alternative learning strategy to improve student learning outcomes, particularly in abstract subjects like algebra. Schools are expected to provide support in the form of technological facilities and infrastructure, training for teachers on digital media use, and policies that encourage sustainable technology-based learning innovation. Future researchers are advised to conduct research with larger sample sizes, more complex experimental designs, and examine other variables such as learning motivation, critical thinking skills, or problem-solving skills to obtain a more comprehensive picture of the effectiveness of learning media.

The implications of this research can be seen from both theoretical and practical aspects. Theoretically, the results reinforce the concept that the use of technology-based learning media, particularly interactive video, can improve learning outcomes by increasing cognitive engagement and visualization of abstract concepts. Practically, this study provides empirical evidence that ALGEBRAVID can be used as a learning innovation relevant to the needs of 21st-century learning, particularly in supporting more interactive, flexible, and learner-centered learning. In addition, the implication for curriculum development is the need for systematic

integration of digital media in the mathematics learning process to improve the quality of learning and student learning outcomes in a sustainable manner.

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