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The Influence of Problem-Based Learning *Game* Education *Wordwall* on the Mathematics Learning Outcomes of Grade V Elementary School Students in Cluster III Mamben Lauk

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Abstrract

Th This study aims to examine the effect of Wordwall-based educational game learning on the mathematics learning outcomes of fifth-grade elementary school students. The background of this research is grounded in the low level of students' interest and achievement in mathematics, which is largely attributed to the use of conventional teaching methods that tend to be less engaging. Through an educational game-based learning approach, students are expected to become more active, motivated, and better able to understand mathematical concepts, particularly topics that are commonly perceived as difficult. The research employed a quasi-experimental method with a post-test only control group design. The sample consisted of two classes: an experimental class that implemented Wordwall-based educational game media in the learning process, and a control class that applied conventional instructional methods. The research instrument was a mathematics achievement test administered after the completion of the learning activities. The results indicated that the mean score of mathematics learning outcomes in the experimental class was 82.05, while the control class obtained a mean score of 71.67, which was rounded to 72. Based on the t-test analysis, the significance value (Sig. 2-tailed) was 0.000 < 0.05, indicating a highly significant difference between the two groups. Therefore, it can be concluded that educational game-based learning has a positive and significant effect on improving the mathematics learning outcomes of fifth-grade elementary school students.

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1. INTRODUCTION

The Indonesian education system undergoes continuous reforms every few years. This is reinforced by the need to develop and develop innovative, efficient, and effective curriculum structures, educational systems, learning methods, and learning models. Improving quality depends heavily on the quality of the education system (Nur & Kurniawati, 2022). The operating system significantly impacts the quality of education. Therefore, it is crucial to understand that the quality of learning is highly dependent on the quality of teachers and the implementation of the learning process (Isrokatun et al., 2021).

The learning process is the process of transforming information, whether in the form of knowledge or teaching materials delivered by teachers or other sources to students through certain tools and media (Sawitri et al., 2019). In implementing learning that prioritizes student understanding, the delivery of information or materials is essential through various means, both verbally and non-verbally, so that the information or messages conveyed by the teacher can be well received by students.

However, in its implementation, it is not free from failures in receiving information or messages from students. Therefore, it is necessary to use appropriate learning media in the delivery of information or materials in learning to take place effectively (Isnaeni & Hildayah, 2020; Umarella et al., 2018). By using appropriate learning media, all information conveyed by the teacher can be well received and understood by students, thereby improving the quality of education. Learning media plays a role in the teaching and learning process, where both are an inseparable unit in the world of education (Tafonao, 2018).

The development of technology in Indonesia, especially in the world of education, has begun to progress so that with the existence of...platform Online media can make it easier for teachers to teach and for students to learn (Savira & Gunawan, 2022). One online application that can foster student learning motivation is media-based educational games Wordwall. Instructional Media Wordwall is an interactive application based on the official website that teachers can use to create practice questions for students. These questions are structured using educational games such as word search quizzes or multiple-choice questions, maze games, true or false, matching games, and more. There are 18 templates available on the official website of Wordwall, which can be accessed easily and free of charge (Sari, 2021).

According to Puspa Ardini, as quoted by Putu & Arimbawa (2021), Wordwall is game education designed for the learning process. Although its function is for learning, Wordwall also contains game elements with a variety of engaging game templates. This ensures students don't get bored or tired quickly when working on the questions given by the teacher in Wordwall.

Learning media plays a crucial role in the learning process because there is often ambiguity in the teaching materials used by teachers (Winara & Haniyyah, 2019). Therefore, teachers must always be creative and innovative in using learning media to facilitate the delivery of material and increase student interest in following the lesson (Rahma, 2019). This statement aligns with research conducted by Tobamba et al. (2019) that learning media influences students' learning interests, which in turn impacts their learning outcomes. Research (Tiwow et al., 2022) also states that the use of appropriate learning media significantly influences student learning outcomes. The use of learning media is very helpful in increasing the effectiveness of learning and, in turn, can increase student motivation and understanding of the material being taught. The use of media is part of a classroom management skill within the framework of learning conditioning and an element of pedagogical competence, which is a key teacher competency (Nisa & Susanto, 2022). Currently, elementary school-aged children are very busy playing games on smartphone they, where the tools and evaluation assessments are fun for students. Game-based education Wordwall is a digital learning application that offers various quiz features with various colors, animations, and sounds that can be used by educators in the learning process. Game Wordwall makes it easier for educators to be creative in evaluating material for students (Khairunisa, 2021).

The problems described above arise from the learning process in the classroom, such as the use of learning media. The learning process in the classroom becomes more engaging when engaging learning media is used, thereby increasing students' motivation to participate in the learning process (Salihah, 2022). A wide variety of learning media can be used, such as educational games. Educational games are a tool for delivering learning materials packaged in the form of games (Permatasari et al., 2020). The presence of educational games in mathematics learning makes students interested in participating in the learning process (Permatasari et al., 2020). Educational games that can be used by educators vary, such as conventional games that utilize physical objects around them or digital educational games based on applications orwebsite which utilizes technological developments.

Based on observations conducted in fifth-grade classes at SDN III Mamben Lauk, several problems were identified in the mathematics learning process. The lecture method was still dominant, resulting in students' lack of active involvement in learning activities. This resulted in students appearing passive and unenthusiastic during the lesson. Furthermore, the limited use of engaging

learning media led to students quickly becoming bored and having difficulty concentrating. This situation resulted in low student understanding. towards the material and their decreased motivation in taking mathematics lessons.

To address the problems that occur in the mathematics learning process in grade V of SDN III Mamben Lauk, it is necessary to implement learning methods and media that are more interesting, interactive, and appropriate to the characteristics of elementary school students. One solution that can be applied is the use of educational game-based learning. Educational games can create a more enjoyable learning atmosphere, increase motivation, and encourage students' activeness in understanding mathematical concepts, especially in fractions. Through this approach, students are invited to learn while playing, so they are more actively involved in the learning process. In addition, the use of educational games can also help students understand the material more concretely and visually. Teachers can also act as facilitators who guide students in solving challenges or questions packaged in the form of games, so that learning becomes more meaningful and not boring.

Because game Education is a medium that can be used to increase students' interest and motivation in learning. Educational game-based learning can create an interactive and enjoyable learning atmosphere, enabling students to be more actively involved in learning activities. In the context of fraction material, the use of game Education can help students understand abstract concepts more concretely. through visualization and exercises packaged in the form of games. In addition, game Education provides challenges and feedback that encourage students to think critically, solve problems, and learn independently. Increased student motivation and engagement lead to improved understanding of the material, which ultimately can positively impact learning outcomes.

2. MATERIALS AND METHODS

This research is experimental research using a quantitative approach, with the type of research used being a quasi-experiment. This study aims to determine the influence of problem-based learning game education on students' mathematics learning outcomes.

The experimental design used is a posttest-only control group design, namely a research design involving two groups (experimental group and control group), but only measurements are taken after treatment *(post-test) without a pre-test.* This is done to avoid the influence of the pretest on student learning outcomes.

Table 1 Research design

Group	Treatment	Post-test
AND	X	THE_1
K	-	THE_2

3. RESULTS

Learning outcome data were obtained from the multiple-choice test scores given after all learning activities were completed. The test results for students in the control and experimental classes can be seen in Table 2 below.

Table 2: Learning Outcome Data of Experimental Class and Control Class

No	Parameter	Post-test	
		Experiment	Control
1	The highest score	100	85
2	Lowest Value	70	50
3	Amount	1810	1255
4	Rate-rate	82	72

a. Descriptive statistical analysis

Descriptive analysis was used to determine the general picture of students' mathematics learning outcomes after implementing an educational game-based learning model. In this study, because it used a descriptive design, *one group posttest only design*, the data analyzed are the values of the *posttest* from one experimental group that had been given treatment in the form of educational game-based learning.

The data obtained from the posttest results were then analyzed descriptively by looking at the average value of *(mean)*, the highest score, the lowest score, and the standard deviation. This analysis aims to determine the extent of student learning outcomes after treatment is given.

Group Statistics

	Student Class	N	Mean	Std. Deviation	Std. Error Mean
Post-test score	Experiment	22	82.05	7.816	1.666
	Control	18	71.67	8.745	2.061

Table 3: Descriptive Analysis Results

b. Normality Test

The normative test was carried out using the test of *Shapiro-Wilk* because the number of samples is < 50 students. Here are the results:

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Student Class	Statistic	Df	Say.	Statistic	df	Say.
Post-test score	experiment	.171	22	.094	.943	22	.225
	Control	.204	18	.046	.927	18	.174

Table 4: Normality Test Results (Shapiro-Wilk)

Based on Table 4 using the test of *Shapiro-Wilk*, it is known that the significance value (Sig.) for the experimental group is 0.225, while for the control group it is 0.174. Because both Sig. values are greater than 0.05 (Sig. > 0.05), it can be concluded that the data on the significance value of *posttest* in both groups were normally distributed.

c. Homogeneity Test

The homogeneity test aims to determine whether the data from the two groups (the experimental class and the control class) have the same variance or not. This test is one of the requirements in parametric statistical analysis, especially before conducting a t-test (*independent sample t-test*). Homogeneity testing in this study uses *Levene's Test for Equality of Variances*. The following are the results of the homogeneity test of the post-test from the experimental class and the control class.

		Levene's Test for Equality of Variances	
		F	Say.
Post-test score	Equal variances assumed	.354	.556
	Equal variances not assumed		

Table 5: Homogeneity Test Results (*Levene's Test*)

Based on Table 5, the Sig. value is 0.556. Because this value is greater than 0.05, it can be concluded that the variance of the post-test data between the experimental and control classes is homogeneous. Thus, the data meet the homogeneity assumption and can proceed to the inferential analysis stage using an independent two-sample t-test.

d. Hypothesis Testing

To find out whether there are differences in learning outcomes between students who use educational games *Wordwall* and those who don't, are tested *Independent Sampel T-Test* to determine whether there is a difference in learning outcomes between the experimental group and the control group. The results are as follows:

t-test for Equality of Means						
					95% Confidence Interval of the Difference	
T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
3.961	38	.000	10.379	2.620	5.074	15.683
3.916	34.541	.000	10.379	2.651	4.995	15.762

Table 6: Hypothesis Test Results (*Independent Sample T-Test*)

Based on Table 6, a significance value of 0.000 (Sig. < 1.684) was obtained, so it can be concluded that there is a significant difference between the post-test scores of students in the experimental class and the control class. The average value (*Mean*) *post-test. The* experimental class was 82.05, while the control class was 71.67, rounded to 72, with an average difference of 10,379 points. This indicates that the learning model applied to the experimental class had a significant influence on student learning outcomes, with a significance value of 0.000.

4. DISCUSSION

This study uses an experimental design, *One Group Posttest Only Design*, namely a research design that only involves one experimental group that is given treatment, then the results are measured*(post-test)* without any *pretest*. However, in the context of this research, the design was developed into two groups, namely the experimental class and the control class, each of which was only given *post*-post-test. The purpose of this design is to determine the effect of the treatment (learning based on a specific model) on student learning outcomes by comparing post-test results between the two groups. Before analyzing differences in results, the data must meet several statistical assumptions, namely normality and homogeneity.

In the initial stage of data analysis, a normality test was carried out to determine whether the data values of the post-test were normal. The data from the experimental and control classes are normally distributed. This test is important because one of the requirements for using parametric tests, such as the t-test, is that the data must be normally distributed. The normality test in this study uses the method of Shapiro-Wilk because the number of samples for each group was less than 50 students.

The results of the normality test show that the significance value (Sig.) for the experimental class is 0.225, and the control class is 0.174. Since both Sig. values are greater than 0.210, it can be concluded that the data from both groups are normally distributed. This means that the data meet the assumption of normality, so the analysis can be continued with parametric tests.

Once the normality test has been met, the next step is to conduct a homogeneity test to determine whether the two groups have the same variance. This homogeneity test uses Levene's Test for Equality of Variances. Homogeneity of variance is a requirement in the two-sample independent t-test so that the analysis results are reliable and valid.

Based on the results of the homogeneity test, a significance value of 0.556 was obtained. Because this value is greater than 0.05, it can be concluded that the variance between the experimental and control classes is homogeneous. Thus, the homogeneity assumption is met, and the data are ready for further analysis using hypothesis testing.

After both assumptions were met, a hypothesis test was conducted using an independent sample t-test to determine whether there was a significant difference in learning outcomes between the experimental and control classes. The test results showed that the average post-test score of students in the experimental class was 82.05, while the control class had an average of 71.67. The average difference of 10.379 points indicates a difference in learning outcomes between the two groups.

The significance value (Sig. 2-tailed) obtained from the t-test is 0.000. Since this value is smaller than 1.684, it can be concluded that there is a significant difference between student learning outcomes in the experimental class and the control class. Thus, the learning provided in the experimental class is Experiments have proven more effective in improving student learning outcomes. These results indicate that implementing an appropriate learning model can have a positive and significant impact on improving student learning outcomes compared to conventional learning.

The findings in this study are in line with the results of a study by Nailil Muna et al. (Nahdlatul Ulama University Surabaya, 2025), which used a test of Wilcoxon on 36 fifth-grade students and found an average positive rating of 18.50 and a significance value of 0.000 < 1.684. Similarly, research by Pebri Dayani Siregar & Melyani Sari Sitepu (UMSU Medan, 2023) on 42 fifth-grade students, which showed an average learning activity in the experimental class of 58.09 (good) vs. the control class 44 quite good, with a value of 0.000 < 1.684.t-test itself. = 0.000 < 0.05. Based on the results of the observation sheet for the implementation of educational game-based learning on the material of multiplication and division of fractions with different denominators in grade V, the teacher has implemented all observed aspects well. The teacher conveyed the learning objectives in a clear and concise manner. The teacher provided clear instructions, explained how to use the educational game, linked the game to the subject matter, and provided easy-to-understand instructions. Furthermore, the teacher guided students throughout the game and concluded the lesson with an evaluation. This demonstrates the teacher's ability to optimally utilize educational game media to support the learning process. In terms of student engagement, observations showed that students actively paid attention to the teacher's explanation and enthusiastically engaged in the educational game activities. They actively participated in group work, enthusiastically answered questions, and demonstrated understanding of the material through the game. These activities indicate that educational game-based learning can increase student motivation, encourage collaboration, and facilitate understanding of the fraction concepts taught. Furthermore, observations also showed that students engaged in discussions or reflections after the game, although the level of engagement varied. These reflection activities are important for strengthening conceptual understanding and providing opportunities for students to connect the gaming experience with the subject matter. Overall, the educational game-based learning in this meeting was effective and was able to activate student participation, increase interaction, and support the achievement of the planned learning objectives.

The results of this study show that the use of learning media of Wordwall has a significant positive influence on student learning outcomes in Citizenship Education (PKN), particularly the material on

diversity in Indonesian society. Wordwall, as an interactive learning medium, can increase student interest and motivation, making the learning process more enjoyable and effective. Students are more enthusiastic about participating in learning activities and are able to better understand the concept of diversity through activities presented in the form of educational games.

These findings align with research conducted by Sari and Putra (2022), who found that interactive game-based learning media such as Wordwall can improve student learning outcomes and engagement in Civics learning. This media helps students internalize material in a fun way and facilitates understanding of abstract concepts such as social diversity. Furthermore, research by Wijaya (2021) also supports that the use of interactive learning media can improve student motivation and learning outcomes because it provides an active and participatory learning experience. Furthermore, the use of Wordwall as a learning medium supports the principles of constructivist learning, which emphasizes active student involvement in constructing knowledge through interaction and direct experience. This enables students not only to memorize material but also to apply the values of diversity in their daily lives. Thus, the application of Wordwall in Civics learning can improve both cognitive and affective aspects of students, which impacts overall learning outcomes.

5. CONCLUSION

Based on the research results and discussions that have been described, it can be concluded that there is an influence of educational game-based learning in mathematics lessons in grade V of SDN 3 Mamben Lauk on student learning outcomes. The post-test data of students in the experimental class and the control class are normally distributed, as indicated by the significance value of the Shapiro-Wilk test of 0.225 for the experimental class and 0.174 for the control class (Sig. > 0.210). In addition, the results of the homogeneity test using Levene's Test showed a significance value of 0.556, which means that the variance of both groups is homogeneous. After both statistical assumptions were met, a t-test (independent sample t-test) was conducted which showed that there was a significant difference in learning outcomes between the experimental class and the control class, with a significant value (2-tailed) of 0.000 < 1.684 proving that the hypothesis no (H0) was rejected and the alternative hypothesis (H1) was accepted, meaning that the use of educational games significantly influenced students' mathematics learning outcomes. The application of an educational game-based learning model allows students to be actively involved in the learning process. Educational games combine cognitive and recreational elements, making students more motivated, less bored, and more easily able to understand the material presented. This may explain why students in the experimental class achieved better results than those in the control class.

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