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The Effect of Wordwall on Elementary School Students Mathematics Learning Outcomes in Multiplication Material

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ABSTRACT

This study aims to determine the effect of the interactive learning media Wordwall on students' learning outcomes in multiplication mathematics material at the fourth grade of SDN Jatibening IV. This study employed a quantitative approach using a quasi-experimental method with a pretest-posttest control group design. The research sample consisted of an experimental class using Wordwall media and a control class using conventional learning methods. Data collection techniques were conducted through learning outcome tests in the form of pretests and posttests, which were then analyzed using statistical tests. The results showed that there was a difference in learning outcomes between the control class and the experimental class. The t-test results obtained a t-count value of 8.608, which was greater than the t-table value of 2.002, with a significance value of 0.000 (< 0.05), indicating that H_0 was rejected and H_1 was accepted. This finding demonstrates that the use of interactive learning media Wordwall has a significant effect on students' mathematics learning outcomes. Therefore, Wordwall proved to be effective in improving students learning outcomes in multiplication mathematics material at the elementary school level. In conclusion, the use of interactive learning media Wordwall has a positive effect on mathematics learning outcomes in multiplication material and can be considered an effective alternative learning medium for improving elementary school students' achievement.

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A. INTRODUCTION

Education plays a strategic role in developing quality human resources that are adaptive to current developments. Education is a planned effort to develop the potential of students to have intelligence, skills, and good character (Rahman, 2021). The educational process does not only focus on the transfer of knowledge, but also on developing students' skills, values, and attitudes (Sukma et al., 2022). In addition, learning is a dynamic interaction between teachers, students, and learning resources that plays a vital role in educational success. Through education, individuals can develop their potential optimally so they are able to face increasingly complex global challenges (Dara et al., 2025). Therefore, effective, meaningful, and innovative learning is key to improving student learning outcomes. In this context, teachers are required to be able to utilize digital technology to create more interactive and engaging learning. (Hartati et al., 2024) The use of technology in learning has been proven to increase student motivation, active participation, and conceptual understanding (Pamungkas & Koeswanti, 2024).

Mathematics, as a basic subject, plays a crucial role in developing logical, systematic, and critical thinking skills in elementary school students (Istianah & Mardani, 2023). Learning mathematics also fosters problem-solving skills in everyday life and fosters a

structured mindset. However, mathematics is often considered a difficult subject due to its abstract nature and the need for strong arithmetic skills (Reyhan et al., 2024.). This difficulty is particularly evident in basic arithmetic operations such as multiplication, which often lead to confusion and poor student understanding. This situation leads to low learning interest and poor student learning outcomes, necessitating innovation in the learning process to make it more engaging and easier to understand.

The use of interactive learning media is one solution to improve the quality of mathematics learning. Learning media functions as a tool to convey information so that it can increase student interest, attention, and understanding (Ain & Mustika, 2021). Interesting and contextual media can increase student attention, participation, and understanding (Nadia & Desyandari, 2022). In addition, the use of appropriate learning media has been proven to increase student motivation and learning outcomes. Technology-based learning media can also help deliver material more easily understood and create a fun learning experience (Rahmadanti et al., 2024). One media that is relevant to technological developments is Wordwall, an educational game-based learning platform that provides various interactive activities such as quizzes and games (Syahyadi et al., 2024). Wordwall allows teachers to create fun learning and increase active student engagement. In addition, the use of Wordwall has been proven to increase student learning motivation and learning outcomes because learning becomes more varied and not boring (Aurillia et al., 2024).

Various previous studies have shown that Wordwall has a positive impact on mathematics learning in elementary schools. (Irna Rusani et al., 2025)found that Wordwall is able to improve students' conceptual understanding and activeness in bilingual mathematics learning, although different in the context of the material and learning approach. Research (Dwi Indriyani et al., 2024)also shows that Wordwall can increase students' learning motivation in multiplication and division materials, which also has an impact on improving learning outcomes, but the focus of the research is still on the motivational aspect. (Prasetiyowati et al., 2024)proved that Wordwall can improve the cognitive learning outcomes of elementary school students, but the research was conducted in lower classes with different material characteristics. (Marlita et al., 2024)that Wordwall increases students' activeness and interest in learning, but is still descriptive qualitative. Meanwhile, (Kholik & Muthi, 2024)shows that Wordwall has an effect on students' interest in learning mathematics, but does not specifically measure learning outcomes as the main variable.

However, most previous research has focused on the use of Wordwalls in other subjects or on general mathematics content without a specific emphasis on multiplication. Furthermore, studies specifically examining multiplication learning in fourth-grade elementary schools using experimental designs involving control groups are still very limited, and existing research has not consistently provided strong comparisons between experimental and control classes in the context of basic arithmetic operations. This condition indicates that empirical evidence regarding the effectiveness of Wordwalls in improving mastery of multiplication concepts as a basic mathematical competency is still inadequate and requires more in-depth testing. Therefore, this study is novel in providing empirical analysis through an experimental design involving experimental and control groups, thus allowing for a stronger and more measurable test of the effects on students' mathematics learning outcomes. The novelty of this study lies in its specific focus on fourth-grade multiplication material and the use of a more rigorous comparative approach, which has not been widely used in previous research. In addition to strengthening causal evidence regarding the effectiveness of Wordwalls, this study also

makes a practical contribution to elementary mathematics learning by demonstrating the potential of interactive game-based digital media in building understanding of arithmetic concepts that form the foundation of mathematics learning.

In line with the urgency of developing digital media-based learning, the learning conditions in the field also show problems that need to be addressed immediately. Based on observations at SDN Jatibening IV, it was found that student learning outcomes in multiplication material were still low and had not yet reached the Minimum Completion Criteria (KKM). This condition is in line with the finding that low learning outcomes are influenced by the limited variety of learning media and the dominance of lecture methods in the learning process (Reyhan et al., 2024). In addition, the use of less innovative media also causes students to be less active and easily bored, resulting in a low understanding of mathematical concepts (Asmini et al., 2025). This indicates the need for more interactive digital media-based learning innovations to improve student learning outcomes.

Therefore, this study aims to analyze the effect of using Wordwall as an interactive learning medium on the mathematics learning outcomes of fourth-grade elementary school students in multiplication. The findings of this study are expected to provide both theoretical and practical contributions to the development of mathematics teaching in elementary schools, particularly in the use of innovative and interactive digital media that align with student characteristics in the digital era. Furthermore, this study is expected to increase the effectiveness of learning and improve student learning outcomes.(Fadilah et al., 2025)

B. METHODS

This research was conducted at SDN Jatibening IV in the even semester of the 2025/2026 academic year. The research used a quantitative approach with a quasi - *experimental method.* The research design applied was *a Pretest–Posttest Control Group Design* involving two groups, namely the experimental class and the control class. The experimental class was given treatment in the form of the use of interactive learning media *Wordwall* in learning multiplication mathematics material, while the control class used conventional learning. The research design used in this study can be seen in **Table 1** below:

Table 1. Research Design *Pretest – Posttest Control Group design*

Class	***Pretest***	***Treatment***	***Posttest***
Experiment	O_1	X	O2
Control	O_3		O_4

The population in this study was all fourth-grade students of SDN Jatibening IV in the 2025/2026 academic year. The sampling technique used *purposive sampling* , so the entire population was used as the research sample (Sugiyono, 2021). The sample consisted of two classes, namely the experimental class and the control class, each with 30 students. The sampling technique used was non-probability sampling with purposive sampling, which is a method of selecting samples based on specific considerations tailored to the research objectives (Sugiyono, 2022). This technique was chosen because the study used a quasi-experimental design, which did not allow for full subject randomization. The sample was determined based on equal academic ability, a relatively balanced number of students, and classroom conditions that supported the implementation of the treatment. Based on these considerations, class IV A was designated as the experimental class, receiving treatment using interactive learning media such as Wordwall, while class IV B was designated as the control class, following conventional learning.

The research procedure was carried out in several stages. The first stage was the preparation stage, which included developing learning materials, developing test instruments, and testing the validity and reliability of the instruments.

The instrument used in this study was a learning achievement test. This test was used to measure students' mathematics learning achievement in the cognitive domain, specifically in multiplication. The instrument was designed based on established learning indicators to represent comprehensive mastery of multiplication concepts. The instrument outline is presented in the following table:

Table 2. Instrument Grid

Learning Outcomes	Learning objectives	Question Indicator	Cognitive Level	Question Format	Question Number
Students can add and subtract whole numbers up to 1,000. They can multiply and divide whole numbers up to 100 using concrete objects, pictures, and mathematical symbols. They can also solve problems involving multiples and factors.	Students are able to identify the concepts and properties of multiplication	Students identify the concept of multiplication as repeated addition.	C2	PG	2,3,8,12,22,25
		Students identify the properties of multiplication	C2	PG	1,6,19,20, 23
	Students can solve multiplication problems of whole numbers	Students calculate mathematical problems involving whole numbers using pictures and mathematical symbols.	C3	PG	5, 13, 14, 21, 24
	Students can apply multiplication operations in solving everyday life problems.	Students analyze contextual problems using multiplication operations	C4	PG	3,7,9,11,16,17,18, 10
		Total			25 Questions

After the instrument outline was compiled, test items were developed according to the established indicators. Next, the instrument was piloted on students with similar characteristics to the research subjects but not included in the research sample. The data from the instrument pilot test were then analyzed through validity and reliability tests. This analysis aimed to ensure that each test item accurately and consistently measured the expected competencies (Slamet & Wahyuningsih, 2022). The results of the instrument validity analysis are presented in the following table.

Table 3. Validity Test Table

Question No.	r count	r table	Information
1	-	0.361	Invalid
2	-	0.361	Invalid
3	0.623	0.361	Valid
4	0.638	0.361	Valid
5	0.886	0.361	Valid
6	0.464	0.361	Valid
7	0.651	0.361	Valid
8	0.158	0.361	Invalid
9	0.754	0.361	Valid
10	0.506	0.361	Valid
11	0.254	0.361	Invalid
12	0.770	0.361	Valid
13	0.502	0.361	Valid
14	0.293	0.361	Invalid
15	0.685	0.361	Valid
16	0.442	0.361	Valid
17	0.638	0.361	Valid
18	0.364	0.361	Valid
19	0.755	0.361	Valid
20	0.249	0.361	Invalid
21	0.782	0.361	Valid
22	0.510	0.361	Valid
23	0.782	0.361	Valid
24	0.838	0.361	Valid
25	0.600	0.361	Valid

Based on the validity test results table, of the 25 questions tested, 19 were found to be valid and 6 were found to be invalid. Therefore, only 19 items were considered suitable for use in the study. Next, a reliability test was conducted, and the results of the instrument reliability test are shown in the following table.

Table 3. Reliability Test Table

R table	*Cronbach Alpha*	Conclusion
0.361	0.90	Reliable

Based on the reliability and validity test table above, it can be stated that the research instrument is reliable and suitable for use in research.

The next stage was the implementation of the research, which began with *a pretest administered* to both groups to determine the students' initial abilities. Next, the experimental class was given a treatment using interactive *Wordwall learning media* for multiplication mathematics, while the control class received conventional learning. After the treatment, both groups were given *a posttest* to measure student learning outcomes after the lesson.

The next step was to analyze the data through several stages, namely analysis requirements testing and hypothesis testing. The prerequisite tests included a normality test using the Shapiro-Wilk test and a homogeneity test using the Levene test (Ghozali,

2018). After the data was declared normal and homogeneous, the analysis continued with an *Independent Sample t-test* to determine differences in learning outcomes between the experimental and control classes. Decision making in hypothesis testing is based on a significance value with a 5% level ($\alpha = 0.05$). If the significance value (Sig.) < 0.05, then H_0 is rejected and H_1 is accepted, which means there is an effect of the use of interactive learning media *Wordwall* on students' mathematics learning outcomes. Conversely, if the significance value (Sig.) > 0.05, then H_0 is accepted and H_1 is rejected.

Next, a Normalized Gain (N-Gain) analysis was conducted based on the pretest and posttest scores in the experimental and control classes. The N-Gain analysis was used as a supporting analysis to illustrate the magnitude of the increase in learning outcomes after learning. The N-Gain value was calculated using the normalized gain formula, then interpreted based on the criteria, namely a g value ≥ 0.70 is included in the high category, $0.30 \leq g < 0.70$ is included in the medium category, and $g < 0.30$ is included in the low category.

C. RESULTS AND DISCUSSION

This study aims to examine the effect of using interactive learning media *Wordwall* on the learning outcomes of mathematics multiplication material in fourth-grade students at SDN Jatibening IV. The research data were analyzed using descriptive analysis and analysis prerequisite tests, followed by hypothesis testing.

Learning Outcome Data Description

Table 4. Student Learning Outcomes Data for Classes IV-A and IV-B

Class	Min	Max	Mean	Standard Deviation
Experiment Pretest	32	79	57.20	14,065
Posttest Experiment	68	95	84.63	6,946
Pretest Control	32	79	58.73	12,069
Posttest Control	42	79	65.70	9,844

Based on descriptive analysis in the experimental class (IV-B) consisting of 30 students, the pretest results showed the highest score of 79, the lowest 32, with an average of 57.20 and a standard deviation of 14.065. After being given treatment using *Wordwall media* , the posttest results increased with the highest score of 95, the lowest 68, an average of 84.63, and a standard deviation of 6.946. Meanwhile, in the control class which also consisted of 30 students, the pretest results obtained the highest score of 79, the lowest 32, an average of 58.73, and a standard deviation of 12.069. In the posttest, the highest score was 79, the lowest 42, with an average of 65.70 and a standard deviation of 9.844 . Overall, these results indicate that the class using *Wordwall media* experienced a higher increase in learning outcomes compared to the control class.

Analyst Prerequisite Test

Normality Test

The normality test aims to determine whether students' mathematics learning outcomes data are normally distributed or not (Sonjaya et al., 2025). In this study, the Shapiro-Wilk normality test was performed because the sample size was less than 50, using *Statistical Product and Service Solutions (SPSS) software*. With the criterion that if the sig. value is > 0.05 (5%), the data is declared normally distributed. The results of the normality test calculation can be seen in the following table:

Table 5. Normality Test Results

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	**Statistic**	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Hasil Belajar	Pretest Kontrol	.138	30	.149	.955	30	.230
	Postest Kontrol	.134	30	.180	.942	30	.100
	Pretest Eksperimen	.144	30	.114	.934	30	.063
	Postest Eksperimen	.136	30	.162	.934	30	.061

a. Lilliefors Significance Correction

Based on the results of the normality test with a significance level (α) of 0.05, the significance value (Sig.) obtained in the experimental group was 0.063 for the pretest and 0.061 for the posttest. Meanwhile, in the control group, the Sig. value was 0.230 for the pretest and 0.100 for the posttest. All significance values were greater than 0.05, so it can be concluded that the pretest and posttest data in both groups came from a normally distributed population.

Homogeneity Test

After the normality test indicates that the research data is normally distributed, the next step is to conduct a homogeneity test. This is an assumption test that aims to verify that the samples studied come from a homogeneous variance. (Sari et al., 2024) . Homogeneity testing uses the Fisher test with the help of *Statistical Product and Service Solutions (SPSS) Software*. The decision making for the homogeneity test is carried out based on the homogeneity test provisions, namely if the sig. value ≥ 0.05 then the data is declared to have the same variance or is homogeneous. The results of the calculation of the homogeneity test for pretest and posttest data can be seen in the following table:

Table 6. Homogeneity Test

Results	**Sig.**	**Significance Level (α)**	**Information**
Pretest (Experimental Class and Control Class)	0.501	0.05	**Homogeneous**
Posttest (Experimental Class and Control Class)	0.056	0.05	**Homogeneous**

Based on the results of the homogeneity test, the significance value obtained for the pretest data of the experimental and control classes was 0.501 and for the posttest data was 0.056. Both values are greater than the significance level (α) of 0.05, so it can be concluded that the variance of both groups in both the pretest and posttest is homogeneous.

Hypothesis Testing

Independent Sample t-test

Based on the results of the analysis prerequisite tests, including normality and homogeneity tests, it can be seen that both data are normally and homogeneously distributed, allowing for the research hypothesis to be tested. The hypotheses tested in this study are:

H_0 : There is no significant influence of the use of interactive learning media *Wordwall* on the mathematics learning outcomes of fourth grade students at SDN Jatibening IV.

H_1 : There is a significant influence of the use of interactive learning media *Wordwall* on the mathematics learning outcomes of fourth grade students at SDN Jatibening IV.

The research hypothesis was tested using a t-test with the criteria of rejecting H0 and accepting H1 if the calculated t value is > t table or the Sig. value is < 0.05. This test was conducted to determine the significant effect of the treatment on students' mathematics learning outcomes. This can be seen from the table of hypothesis test criteria as follows.

Table 7. Results of the Independent Sample Test Hypothesis

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil Belajar	Equal variances assumed	3.802	.056	-8.608	58	.000	-18.933	2.200	-23.336	-14.530
	Equal variances not assumed			-8.608	52.139	.000	-18.933	2.200	-23.347	-14.520

From the calculation results obtained thitung = 8, 608, while t tabel = 2,002 or the Sig. value obtained is 0,000. Based on the results of the table above, it can be seen that thitung > t tabel, namely 8,608 > 2,002. This H0 is rejected and H1 is accepted, which means there is a significant influence of the use of interactive learning media *Wordwall* on the mathematics learning outcomes of fourth grade students of SDN Jatibening IV.

In addition, the test results show a 95% confidence interval for the mean difference ranging from -23.30 to -14.56. Since the entire confidence interval range does not cross the value of 0, it can be concluded that the difference in learning outcomes between the experimental and control classes is consistent and does not occur by chance. The confidence interval also shows that the use of interactive learning media Wordwall not only has a statistically significant effect, but also has a real practical impact on improving students' mathematics learning outcomes. Thus, this finding confirms that the use of interactive learning media Wordwall in the experimental class has a positive effect on students' mathematics learning outcomes in multiplication material.

N-Gain Test

After hypothesis testing using Independent Sample t-test, the analysis was continued with Normalized Gain (N-Gain) test to determine the level of improvement in student learning outcomes based on pretest and posttest scores in the experimental and control classes. N-Gain analysis was conducted as a supporting analysis to describe the magnitude of improvement in learning outcomes obtained by students after participating in the learning process. The N-Gain value was then interpreted based on the criteria, namely the high category ($g \geq 0.70$), the medium category ($0.30 \leq g < 0.70$), and the low category ($g < 0.30$). The following table presents the results of the N-Gain test.

Table 8. N-Gain Test

Class	N-Gain	Category
Experimental Class	0.64	Medium
Control Class	0.15	Low

Based on the results of the N-Gain test, the average N-Gain in the experimental class was 0.64, which is included in the medium category, while the control class obtained an average N-Gain of 0.15, which is included in the low category. This shows that the increase in student learning outcomes in the experimental class using Wordwall interactive learning media is higher compared to the control class using conventional learning. Thus, it can be concluded that the use of Wordwall media provides better learning outcomes in learning mathematics multiplication material compared to without the use of the media.

The findings of this study align with previous research showing that the use of interactive Wordwall media influences elementary school students' mathematics learning outcomes (Millah et al., 2025). This finding is further supported by various studies that suggest that learning media can improve student motivation and learning outcomes through active engagement in the learning process (Hidayah & Iswata, 2023; Utami et al., 2024). Technology-based learning media can create a more enjoyable learning environment and enhance students' conceptual understanding.

Furthermore, the development of digital technology has become a vital part of the world of education. One widely used platform is Wordwall, which has the potential to create more innovative and interactive learning. Wordwall is a game-based learning application that allows teachers to create interactive activities such as quizzes, match-the-pairs, and other educational games, thereby increasing student engagement and facilitating the evaluation of learning outcomes. (Azizah et al., 2023)

Based on the various research findings, it can be concluded that the use of interactive learning media, Wordwall, plays a significant role in increasing student engagement and mathematics learning outcomes. This demonstrates that the use of interactive digital media not only makes learning more engaging but also more effective in achieving learning objectives. Therefore, Wordwall can be a viable alternative learning medium for use in elementary school learning.

In elementary school mathematics multiplication, Wordwalls are a relevant medium due to the gradual nature of multiplication, which progresses from concrete to abstract, is based on the concept of repeated addition, and requires repeated practice to master basic facts. Wordwalls provide interactive, repetitive, and fun learning activities such as quizzes, matching pairs, and educational games, allowing students to practice continuously without getting bored. (Hartanti et al., 2026)

The use of Wordwalls also aligns with constructivist theory, which emphasizes that students construct their knowledge through active learning experiences. Through direct interaction with learning media, students not only passively receive information but also actively explore and discover multiplication concepts independently. Furthermore, Wordwalls support behaviorist theory by providing stimuli and responses in the form of practice questions and direct feedback in the form of scores and assessments, which serve as reinforcement to increase student motivation and engagement in learning.

D. CONCLUSION AND SUGGESTIONS

Based on the research results, it can be concluded that the use of interactive learning media *Wordwall* has an effect on the mathematics learning outcomes of the multiplication material in fourth-grade students of SDN Jatibening IV. This is evidenced by the increase in learning outcomes in the experimental class which is higher than the control class. Thus, the *Wordwall media* is proven effective in improving student learning outcomes in the multiplication material.

Teachers are advised to utilize interactive *Wordwall learning media* as an alternative in mathematics learning to increase student interest and learning outcomes.

Furthermore, future researchers are expected to expand this research by using other variables, different materials, or combining *Wordwall* with other learning models to achieve broader and more in-depth research results.

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