



The Effectiveness of Interactive Media Wordwall to Improve the Interest of Grade IV Elementary School Students in Learning Mathematics

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ABSTRACT

The purpose of this study was to determine the effectiveness of interactive media Wordwall in increasing interest in learning mathematics in class IV primary school. This study uses a quantitative quasi-experimental method with a one-group pretest-posttest design at SD Negeri 77 Buton with 20 students in class IV-B. The data collection was carried out through a questionnaire of learning interests before and after the conduct of two meetings of learning using Wordwall-based learning. Data were analyzed using descriptive statistics, the Shapiro-Wilk test for normality, and a paired-samples t-test. The results showed that the normality assumption was met ($p = 0.591$), and the paired-samples t-test showed a significant difference between pretest and posttest scores ($t = -7.616$, $p < 0.001$). The results indicate that Wordwall is beneficial in improving students' enthusiasm for learning mathematics. We present empirical evidence on the affective impact of digital game-based media in teaching primary mathematics.

INTRODUCTION

Elementary school mathematical learning has an important role in shaping students' logical, methodical, and problem-solving skills from the early stages of schooling (Pradani & Nafi'an, 2019; Wahyudi & Siswanti, 2015). Mastery of mathematical ideas at this level is an important basis for the cognitive growth of kids in facing scholastic obstacles and situations in daily life (Herlina et al., 2022). Proper teaching not only provides students with the ability to compute but also trains them to think critically and create their own solutions to the various difficulties they encounter (Pradani & Nafi'an, 2019). Reasoning development and the habit of logical thinking are the key aims that must be attained in basic education, with this very important role (Wahyudi & Siswanti, 2015).

Mathematics is a vital topic but nevertheless many primary school children are not interested in learning it because it is generally considered as abstract, difficult, and less attractive (Ramdhani & Baadilah, 2022; Sugiyanta et al., 2023). The abstract nature of mathematics as a study object is often not in accordance with the cognitive development stages of primary school children who still need a tangible approach (Ramdhani & Baadilah, 2022). Hence, many students have problems understanding concepts which eventually results in negative attitudes, boredom, and insecurity when handling arithmetic problems (Astriani & Akmalia, 2022; Sugiyanta et al., 2023). This state will be worse if teachers rely solely on lecture methods without using media that can bridge understanding of the idea (Sugiyanta et al., 2023).

Interest in learning is one of the affective factors that govern students' involvement in the mathematics learning process. Students with high interest tend to be more active, conscientious and enthusiastic in participating in learning activities (Herzamzam, 2018). Interest in learning is an internal motivator that encourages people to be interested in learning which can provide a feeling of delight and feelings to participate in learning activities (Aliyyah et al., 2022; Herzamzam, 2018). If students have a high interest in mathematics, they will be more engaged in the tasks, hence the learning results will be higher (Aliyyah et al., 2022; Herzamzam, 2018).

The poor interest of primary school pupils in learning mathematics makes the teachers to make more contextual learning that is participatory and follows the students' developmental aspects (Hamidah & Ain, 2022; Sugiyanta et al., 2023). If the children are not motivated to do the learning activities in the classroom, their numeracy will diminish (Isnaini et al., 2023). Therefore, the learning process should be designed to attract the attention of students and bring happiness to them, especially in subjects that are considered boring such as mathematics (Hamidah & Ain, 2022; Isnaini et al., 2023). It needs the proper instructional method so that the students do not feel bored and are actively involved in the study of the topic (Hamidah & Ain, 2022).

The usage of digital learning media is an important pedagogical method to increase student engagement and excitement in mathematics learning in the era of educational technology (Oktavianita & Wahidin, 2022). The period of digitalization has been part of many fields of education, and the use of computer media and the internet can assist in creating a more effective, efficient, and

pleasant learning environment for students (Oktavianita & Wahidin, 2022). Interactive digital media can create a more concrete learning experience for students compared to conventional learning, so that the student's curiosity and excitement will be aroused (Oktavianita & Wahidin, 2022; Paseleng & Arfiyani, 2015).

Wordwall is a digital interactive media where the teacher can present mathematics materials through educational games, quizzes, matching, and interactive exercises that can promote students' involvement (Oktavianita & Wahidin, 2022). The game-based aspects of Wordwall can turn abstract mathematical topics into an enjoyable activity, thereby boosting students' interest in researching the content (Aminah et al., 2025; Shalsabila et al., 2024). This medium is not only a teaching tool but also a tool that enhances the relationship between teachers and students in the classroom (Oktavianita & Wahidin, 2022).

Some previous studies have shown that the use of interactive media can improve student motivation, participation, and learning outcomes. However, research that particularly examines the impact of Wordwall on primary school students' enthusiasm in learning mathematics needs to be increased (Maulidina et al., 2025; Shalsabila et al., 2024). Various studies have studied the effects of digitally based interactive media on academic accomplishment, but few studies have comprehensively studied the emotive dimensions of learning interest utilizing Wordwall (Lestari et al., 2025; Shalsabila et al., 2024). Therefore, it is necessary to conduct further empirical investigations to determine the extent to which this medium can have a specific good impact on aspects of the learning interest of elementary school pupils.

The importance of this research gap is that the interest in learning mathematics in grade IV elementary school students is not only related to momentary responses to media, but also to how interactive media is able to build students' attention, pleasure, engagement, and willingness to learn mathematics (Aliyyah et al., 2022; Herzamzam, 2018). It is vital to note that the focus on learning interests is due to the fact that persistent interests are long-term determinants of students' performance in grasping mathematical topics (Aliyyah et al., 2022; Herzamzam, 2018). Interactive media like Wordwall need to be tested to determine whether they can provide a learning experience that is pleasurable to use and encourages continual readiness to learn (Shalsabila et al., 2024).

Given this urgency, this study aims to analyze the impact of using the interactive media platform Wordwall on interest in learning mathematics among Grade IV primary school pupils. This research will focus on assessing the extent to which media use can boost indicators of student learning interest, such as attention, enjoyment, interest, and involvement in the learning process. It is envisaged that the results of this research can provide a practical contribution to instructors in optimizing innovative and relevant mathematics learning approaches to meet the needs of primary school students. Furthermore, this finding is expected to serve as an empirical reference for educational practitioners in embedding edugames as an innovative solution to address low motivation and low activity among students in the classroom, thereby creating a

more dynamic educational ecosystem that optimally supports students' cognitive and affective needs.

METHODOLOGY

Research Design

This study was quantitative and used a quasi-experimental method. More specifically, this study used a one-group pretest-posttest design to investigate the impact of interactive Wordwall media on students' enthusiasm for learning mathematics. This approach was chosen because the study sought to examine students' learning interest before and after the implementation of Wordwall in mathematics learning, using the same participants. In this design, the pretest was administered to assess students' initial level of learning interest before the treatment, whereas the posttest was administered to determine whether there was a significant change in students' learning interest after participating in the Wordwall-assisted learning activities.

A one-group pretest-posttest design was chosen as appropriate for the classroom intervention, given that the research was conducted in a real school environment and included an entire class. Although this design lacks a control group, it allows the researcher to identify changes in students' interest in learning following the implementation of a specific instructional therapy. Thus, the design provides empirical evidence of the potential effectiveness of interactive Wordwall media in promoting mathematics learning in elementary schools.

Research Setting and Sample

This research was conducted in SD Negeri 77 Buton, Indonesia, involving fourth-grade students. The school had two fourth-grade classes, and the sample was drawn from Class IV-B, comprising 20 pupils. The pupils in this class were all given a pretest, then underwent a learning intervention using interactive Wordwall media, and finally took a posttest. The pupils were fourth graders, as they were believed to be developmentally competent to acquire structured mathematical ideas, and interactive digital media were believed to increase engagement and enthusiasm in learning.

Sampling Method

This study used random sampling at the class level. Random assignment was used to pick one of the two available fourth-grade classrooms as the experimental group. Class IV-B was treated as a single intact group because the intervention was conducted in a natural classroom context. This selection strategy is widely employed in school-based quasi-experimental studies when it is not possible to randomly assign individuals for educational and administrative reasons.

Research Variables

This study has one independent variable and one dependent variable. The independent variable is the usage of the interactive Wordwall media in studying mathematics, whereas the dependent variable is the interest of students in learning mathematics. Wordwall interactive media is a digital learning platform where teachers may build game-based interactive learning activities like quizzes, matching activities, word games, and other ways to get students involved.

Wordwall was used in this study as an educational tool to support students' participation in mathematics learning activities.

Students' interest in learning mathematics was operationalized as students' tendency to demonstrate attention, enjoyment, involvement, and willingness to participate in mathematics learning. The learning interest was examined before and after the treatment using a learning interest questionnaire designed based on the variables associated with primary mathematics learning. The comparison of the pretest and posttest scores was utilized to find out whether the usage of Wordwall interactive media gave a substantial improvement to students' motivation in studying statistically.

Research Procedures

The research technique consisted of three primary stages: planning, implementation, and data analysis. In the preparation stage, the researcher made the teaching module, observation sheet, and students' mathematics learning interest questionnaire. The teaching module is meant to facilitate the application of learning mathematics by using interactive media, Wordwall. The observation sheet was developed to observe the execution of the learning process, and the questionnaire was utilized to determine students' interest in learning mathematics before and after the therapy.

In the implementation phase, the researcher first conducted the pretest to determine the students' initial enthusiasm in learning mathematics. After the pretest, the therapy was carried out in the form of mathematical learning exercises accompanied by interactive Wordwall media. The learning exercises were performed in two classroom meetings. During the treatment, Wordwall was employed to deliver learning tasks and interactive activities that promoted active participation from students in mathematics learning. The teacher supported the learning process by guiding the students to access, react, and debate the activities based on Wordwall. The posttest was given at the end of the therapy using the same learning interest questionnaire to examine the changes in students' interest following the intervention.

The last step was that the results from the pretest and posttest were tallied and examined quantitatively. The analysis was focused on identifying the difference in learning interest of students before and after the adoption of Wordwall interactive media statistically significantly. After that, the analysis findings were evaluated to determine the efficiency of Wordwall in increasing students' interest in learning mathematics.

Research Instrument

Instruments utilized in this study were an instructional module and a mathematics learning interest questionnaire. The teaching module was a guideline to apply mathematics learning by using Wordwall interactive media. It also included the learning objectives, learning activities, instructional stages, learning materials, assessment activities, and the integration of Wordwall in the mathematical learning process. The major instrument utilized for obtaining quantitative data was the mathematics learning interest questionnaire. The questionnaire was administered at two points in time, before and after treatment.

The students' responses were quantitatively assessed to get pretest and posttest data for statistical analysis.

Technique of Data Collection

Data collection was through questionnaire administration. The questionnaire was administered as a pretest before the Wordwall-based learning intervention and as a posttest after the intervention. The pretest data were the initial interest of students in learning mathematics, and the posttest data were the interest of students in learning mathematics after experiencing mathematics learning utilizing Wordwall interactive media.

Analysis of data

Data were quantitatively analyzed using JASP statistical software. Descriptive statistics were used to summarize students' pretest and posttest scores, such as mean, standard deviation, minimum and maximum, and the analysis began with these. Descriptive statistics were utilized to provide an overview of students' learning interest before and after the introduction of Wordwall interactive media.

The normality of the data was checked before hypothesis testing to determine whether the pretest and posttest scores matched the assumptions required for parametric analysis. If the data was regularly distributed, the hypothesis would be tested using a paired-samples t-test. The study evaluated two related sets of scores from the same group of students before and after treatment; hence, a paired-samples t-test was used. The significance threshold was 0.05. A significance value of less than 0.05 represented a statistically significant difference between the students' pretest and posttest results.

RESEARCH RESULT

Data Description of Math Learning Interest Score

This research used a one-group pretest-posttest design, testing the interest in studying mathematics before and after the students participated in learning with the use of Wordwall interactive media. The number of participants who participated in the pretest and posttest assessments was the same, namely 20 students, so that the change in scores could be examined in pairs. The data contained pretest and posttest scores averaging 47,300 and 56,450, respectively.

Table 1. Analysis of the Results of Mathematics Learning Interest Measurement

Test	N	Mean	SD	SE	Coefficient of variation
Pretest	20	47.300	6.001	1.342	0.127
Posttest	20	56.450	2.685	0.600	0.048

As shown in Table 1, the mean score of students on mathematics interest improved from 47,300 in the pretest to 56,450 in the posttest. The average difference of 9,150 points indicated an increase in learning interest levels after students participated in learning using Wordwall interactive media. The rise is around 19.34% of the average pretest score from the first score.

Besides the average gain, the analysis also indicated less variability in scores. The standard deviation number reduced from 6.001 in the pretest to 2.685 in the posttest. The drop suggests that the students' learning interest scores

become more homogeneous after using Wordwall. This is also corroborated by the coefficient of variation, which decreases from 0.127 to 0.048. Thus, the rise in interest in studying mathematics can be shown not only from the rise in the average scores but also from the more even scores of the students after the usage of the interactive media Wordwall.

The results of the research descriptively indicate that the usage of Wordwall interactive media can improve students' enthusiasm in learning mathematics. However, the descriptive analysis is not adequate in order to prove the importance of the increases; we need to perform inferential tests such as paired difference tests.

Raincloud Plots of Changes in the Mathematics Learning Interest Score

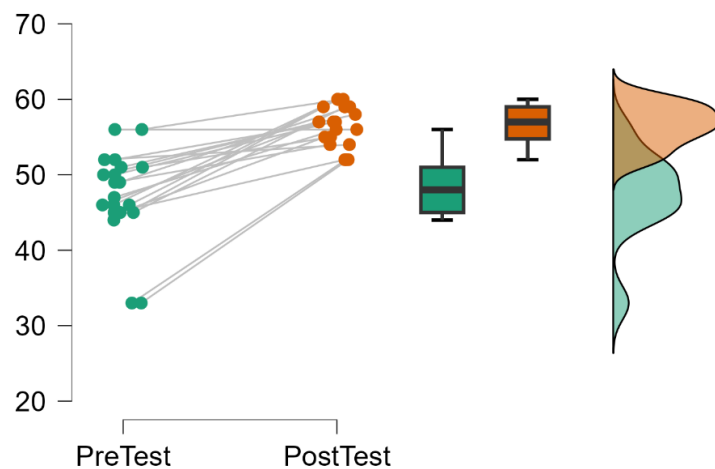


Figure 1. Raincloud Plots of Changes in the Mathematics Learning Interest Score

The raincloud plot in Figure 1 reveals a trend for the score of mathematics learning interest to grow from pretest to posttest. The line connecting the measurement points reveals that most students had an increase in scores after participating in Wordwall-based learning. This pattern implies that the progress is not just in the average group but also in most learners individually.

The boxplot in the visualization in Figure 1 reveals a movement in central tendency toward higher scores on the posttest. The range of the posttest results also seems to be narrower than that of the pretest, which indicates that the interest in learning mathematics after using Wordwall grown more concentrated. Also, the score distribution reveals a movement towards higher values in the density plot. These visual findings reflect the descriptive results indicating the use of Wordwall is followed by a rise in students' mathematics learning interest scores.

Raincloud plots of the distribution of PreTest-PostTest score differences

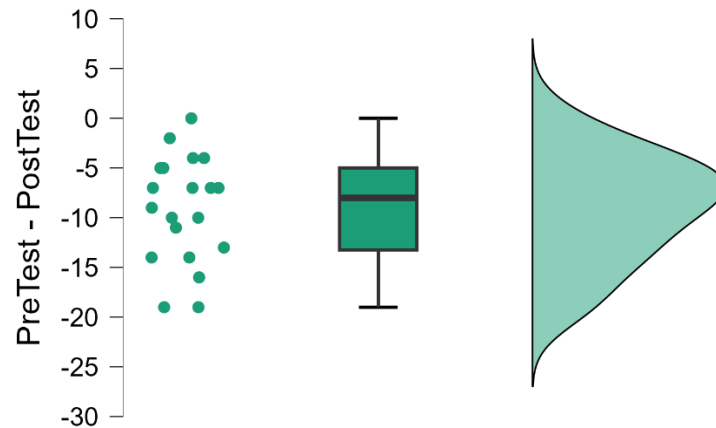


Figure 2. Raincloud plots

Raincloud plot in Figure 2, illustrating the distribution of PreTest-PostTest score discrepancies. The formula utilized is $\text{PreTest} - \text{PostTest}$. So, a negative value means the PostTest score is greater than the PreTest score. Therefore, the larger the negative score, the greater the gain in score after learning via Wordwall Media. The figure reveals that most participants obtained higher PostTest results. This is evident in practically all data points falling below 0, with values ranging from -2 to -19. PostTest scores were not positive, so descriptively, no subjects scored lower following the PostTest. A point near or at 0 suggests that certain participants are unlikely to have a change in score from PreTest to PostTest.

The scatter plot on the left shows how the increases differ amongst individuals, indicated by the dots. Most individuals scored between -5 and -14, implying that their score changes within that range were rather stable. Some participants had moderate increases, around -2 to -4, and some had higher increases, about -16 to -19. This shows that the treatment impact was not the same for all subjects, but that the direction was likely good because almost all difference scores were negative.

The middle part presents a boxplot summarizing the distribution of the data. The median was about -8; hence, the median gain for participants was about 8 points. The boxplot seems to be in the region of -13 to -5; therefore, most of the data is in this area. The lower whisker is approximately -19, and the upper whisker is approximately 0. This means that the benefits could be anywhere from none to rather substantial.

The graphic at right displays the density of the data distribution. The distribution has its thickest part between -6 and -10; therefore, this is where the rise is most common. The distribution also extends to more negative values, demonstrating that some participants improve more than others.

Normality Testing

Before applying the paired difference test, the normality test was conducted on the difference between the pretest and posttest scores. The normality test utilized was Shapiro-Wilk because the sample was somewhat small, namely 20 pupils.

Table 2. Normality Testing

	W	p
PreTest-PostTest	0.962	0.591

The Shapiro-Wilk test results in Table 2 are $W = 0.962$ and $p = 0.591$. The significance value is more than 0.05; therefore, the difference score data of the pretest and posttest are not significantly deviated from the normal distribution. This indicates that the normalcy assumption is met.

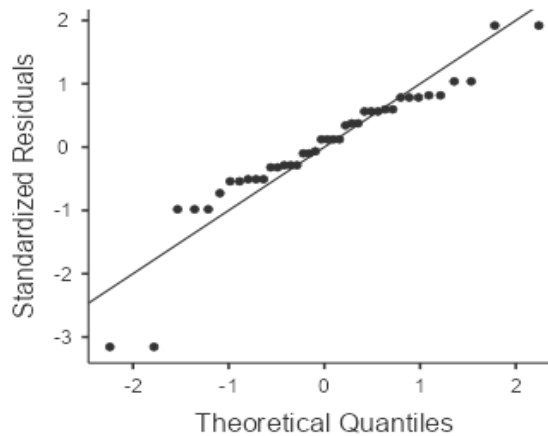


Figure 3. Q-Q plot

The Q-Q plot in Figure 3 depicts the link between theoretical quantiles and standardized residuals. This graphic is used to check whether the data are normally distributed. Most of the dots in the picture are around the diagonal line. This indicates that, generally, the data distribution is regularly distributed. The dots in the center look relatively tight and follow the diagonal line, which means most of the data follow a distribution pattern that is consistent with the assumption of normality. There are some small deviations in the lower tail, i.e., certain locations on the lower left-hand side are a little bit away from the diagonal line. Such a modest variance can be considered reasonable even in the case of a relatively small sample count, i. e. $N=20$. The data were normally distributed, as indicated by the results of the Shapiro-Wilk test, which were supported by the Q-Q plots. Therefore, the analysis can continue with the paired-samples t-test.

Hypotheses Testing

The paired samples t-test was performed to examine whether there was a significant difference in interest scores in studying mathematics before and after using Wordwall interactive media. The test was consistent with the research design because the data were collected from the same group of learners and measured at two separate times, i.e., before and after the treatment.

Table 2. Student's t-test

Measure 1	Measure 2	t	df	p
PreTest	PostTest	-7.616	19	<0.001

Note. For all tests, the alternative hypothesis is that PreTest < PostTest.

The paired samples t-test findings showed that $t(19) = -7.616$, $p < 0.001$. A significance value of .05 or less suggests that there is a significant difference between pretest and posttest results. The t-value is negative due to the sequence of Pretest – Posttest calculations. The average posttest score is higher than the pretest; hence, the difference is negative. The results showed that there was a considerable increase in the students' enthusiasm in learning Mathematics after using the interactive media Wordwall. Therefore, the results of the inferential test were similar to the descriptive analysis, where the average score improved from 47.300 to 56.450, a difference of 9.150 points. Substantively, these data indicate that the usage of Wordwall interactive media is successful in increasing students' interest in learning. This increase is evident in the mean and is also statistically significant.

Discussion

The results of this study show that the use of interactive media Wordwall has a beneficial effect on increasing the interest in learning mathematics for Grade IV elementary school pupils. This is in accordance with the results of previous studies, which state that the integration of interactive media can increase students' enthusiasm to participate in learning, especially in mathematics subjects which often require a creative and non-monotonous approach (Maulidina et al., 2025; Shalsabila et al., 2024).

The improvement score from pretest to posttest shows that math learning using Wordwall provides a more interesting and fun learning experience to pupils. The introduction of game aspects in Wordwall has had a considerable impact on students' impression of mathematics, from being perceived as uninteresting and abstract to a more concrete activity (Aminah et al., 2025; Oktavianita & Wahidin, 2022).

The pattern of improvement in the raincloud plot supports the observation that changes in learning interest occur not only in the average scores of the group but also in the tendency to grow in practically all the students. This suggests that the effectiveness of this media is inclusive, accepting various profiles of students in the classroom to be more active and give a more favorable response to the material given (Paseleng & Arfiyani, 2015).

The more concentrated distribution of posttest results compared to pretests indicates that the use of Wordwall not only boosts general interest in learning, but also helps promote a more even learning response across students. Thus, it reduces the distance of interest between students and builds a harmonious, cohesive, and pleasant atmosphere of learning in mathematics learning in the classroom (Oktavianita & Wahidin, 2022; Shobirin et al., 2025).

The reason Wordwall is so effective is that it features elements that make it an interactive learning medium. It includes game aspects, visualization, rapid feedback and challenge-oriented activities that are suitable for the learning and growing features of elementary school pupils. This is in line with students'

psychological needs to receive instant pleasure and gratification after grasping mathematical principles that are generally difficult (Ferlina & Fratiwi, 2024; Oktavianita & Wahidin, 2022).

Wordwall can change the view of math as a difficult and abstract lesson in learning math, by turning the principles and exercises of math into more practical, competitive, and interesting digital games (Aminah et al., 2025; Sugiyanta et al., 2023). This change allows students to visualize the arithmetic problem, which has a direct effect on their motivation to learn more comprehensively and their focus in the process of learning the material (Maulidina et al., 2025; Paseleng & Arfiyani, 2015).

The results of paired-samples t-test showed that the difference in the level of learning interest before and after the use of Wordwall was statistically significant. This provides evidence for the hypothesis that the observed increase in attention is driven by the intervention of the implemented medium and not by chance or random variation (Lestari et al., 2025; Maulidina et al., 2025).

The results of this study are valuable for primary school math teachers to employ interactive media such as Wordwall as a learning tool to promote students' attention, involvement, and love in mathematics (Ferlina & Fratiwi, 2024; Shobirin et al., 2025). Teachers are expected to be facilitators, not just material presenters, who are capable of using digital technology to create a more dynamic, innovative, and relevant learning ecosystem to the needs of students in the classroom (Dara et al., 2025; Oktavianita & Wahidin, 2022).

The results of this study support the concept that the interest of students in studying mathematics is determined not only by students' internal traits but also by the design of learning, the media employed, and the quality of interaction built during the learning process. This study confirms the relevance of affective factors for educational performance, where the choice of adequate instruments can act as a spark for students' sustainable motivation and commitment (Isnaini et al., 2023).

CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicate that the interactive media platform Wordwall was helpful in promoting interest in learning mathematics for grade IV primary school students. This was proven by the increase in the average score of learning interest from 47,300 in the pretest to 56,450 in the posttest, and the findings of the paired-samples t-test with $t(19) = -7,616$, $p < 0.001$, showing a significant difference before and after treatment. Based on the results of this study, Wordwall can offer more fascinating, exciting, and engaging learning experiences for students in mathematics. Therefore, the interactive media of Wordwall can be employed as an innovative learning alternative to enhance the development of students' affective elements in primary school.

ADVANCED RESEARCH

Findings indicated a significant effect, although the study had the drawback that it used a one-group pretest-posttest design with no control group. The effect of factors other than treatment has not been entirely removed. These external

elements may vary during cultivation, such as the health of the students. More rigorous experimental designs, such as the use of a control group, higher sample sizes, longer treatment duration, and additional analyses such as effect size, are advised to gain a fuller picture of the usefulness of Wordwall in mathematics learning. Further, a full, comprehensive investigation of the long-term effect of these media on content retention and student learning outcomes is a most relevant field for future investigation.

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