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The Effect of Using Edugame Wordwall on Students' Mathematical Representation Ability

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ABSTRACT

The difficulty students face in comprehending problems presented through diagrams and mathematical models, coupled with the monotony experienced during mathematics lessons, has resulted in low mathematical representation skills among students. While studies indicate that Wordwall can enhance student engagement, the specific factors influencing this engagement when utilizing Wordwall remain under-explored. This study aims to assess the impact of Wordwall media on students' mathematical representation abilities and determine the extent of this influence. Adopting a quantitative research approach with experimental methods, the researchers employed a post-test-only design using cluster random sampling. Class VII-A was designated as the experimental group, while Class VII-B was the control group. Data were gathered through a post-test essay examination. Analytical techniques involved prerequisite tests (normality and homogeneity) and hypothesis testing (t-test and effect size). Results indicated a significance level of 0.008 in the t-test and an effect size of 0.685, suggesting that using Wordwall media has a moderate yet significant positive effect on students' mathematical concept representation skills. The findings reveal that incorporating Wordwall edugames in classroom instruction can enhance students' mathematical representation capabilities, foster an interactive learning environment, and improve students' self-expression. Consequently, Wordwall has been proven to elevate student engagement in learning and can effectively supplement traditional classroom instruction.
Keywords: Edugame, Wordwall, Mathematical Representation Ability

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INTRODUCTION

Mathematical representation ability refers to a person's ability to understand, present, and use mathematical concepts in various forms and involves the use of symbols, graphs, tables, and mathematical expressions to describe mathematical problems or situations. This is in line with what is said Faridah & Nasikhah (2019); Salsabila et al. (2023), & Susilawati (2020) mathematical representation is the ability to combine learned material, logic, communication, and problem-solving in various ways. This ability includes the ability to relate mathematical concepts in various ways. An expression of students' ideas and ideas in solving mathematical problems.

Mathematical representation skills are essential for students because students can find it easier with mathematical representation skills to determine strategies in working on math problems. This is in line with what was said by Mainali (2021). The ability to represent helps students understand abstract mathematics to be accurate. Learners need to be able to represent mathematical concepts into tools or ways of thinking that can communicate mathematical ideas from abstract to concrete so that they are easier to understand. Indicators of learners' representation skills include visual representation, which refers to the ability of learners to depict data or information in the form of diagrams, graphs, or tables; representing mathematical formulas or expressions involves creating equations or models to solve problems; written representation involves conveying the steps of solving mathematical problems in words and answering questions based on given data or representations (Paseha & Firmansya, 2019).

Students' mathematical representation skills are still low; this is in line with what was said by Fadillah et al. (2020) that students' mathematical representation skills are still low, from the results of observations in his research It has been discovered that students are unable to solve math problems effectively, meaning that students solving math problems are still low. Also, students still have difficulty understanding the use of notation or symbols, so they have difficulty determining strategies for solving the problems given. This aligns with what Sari et al. (2023) say: Students struggle to articulate the solution to the problem in both written and spoken language. Besides that, students struggle to represent problems using mathematical notation or symbols. This causes difficulties for them when faced with non-routine problems Santia et al. (2019).

In this study, the author made preliminary observations regarding mathematical representation skills at one of the State Junior High Schools in Jakarta. The findings from summative test 1, even the semester of the 2023-2024 school year, on the material of the relationship between angles, The average of the results obtained from the initial observation is that it does not meet the indicators of images and mathematical expressions or models.

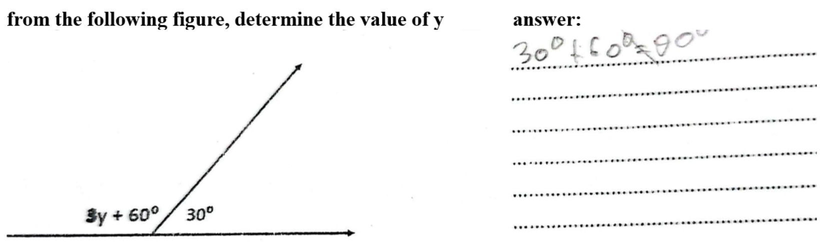

Figure 1. Student’s answer

Figure 1 shows that students still have difficulty understanding the problems given and using mathematical notation or symbols.

This aligns with what the author found in one of the State Junior High Schools in Jakarta. The error found was that students were less able to understand the content of the picture and did not understand what was in the problem given by using mathematical notation or symbols to answer the problem. So, in line with (Sari et al., 2023), learners have difficulty representing problems using mathematical notation or symbols.

One of the reasons students' mathematical representation skills are low is because students' lack of mathematical representation ability can also be attributed to the diminished level of interaction in the learning process. So, participants quickly feel bored when learning is taking place. This research conducted by (Suwanti & Maryati, 2021) said that few students seemed to experience boredom when learning math. Mathematical representation ability can be improved by using learning media. This aligns with the findings of the research carried out by (Nurhayati & Gunawan, 2022). This study noted a significant increase in mathematical representation ability using the Desmos graphing calculator compared to those who did not use it. One of the tools that can be used for learning is Wordwall. The research conducted by (Lubis & Nuriadin, 2022) said that using Wordwall in learning proved effective, and its impact improved student learning outcomes. Wordwall helps students remember the material taught and increases motivation and enthusiasm for learning. (Rachmawati et al., 2020) Also, it was said from their research that using a generative learning model in the application of mathematics learning activities supported by Wordwall media will help or make it easier for students to remember and arouse enthusiasm for learning mathematics.

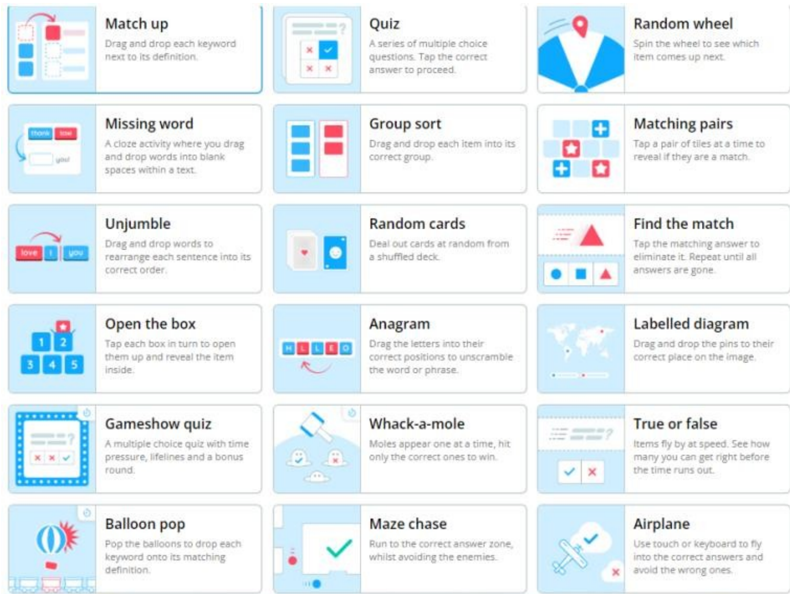

Figure 2. Wordwall Features

Wordwall is a web-based platform designed to create an engaging and interactive learning experience not only as a learning resource but also as an engaging assessment tool (Al-Qonita et al., 2022; Noor et al., 2023; Shofiya Launin et al., 2022). Wordwall learning media can be utilized to create a more effective and efficient learning environment without reducing the essence of the material delivered by the teacher (Triyani, 2023). The advantage of Wordwall is that it has many templates. Games that have been created can be directly shared via a link and can be sent via WhatsApp, Google Classroom, or email applications. Moreover, another advantage of this application is that the teacher can print the developed game in PDF format, which can help students who have network problems (Rinov et al., 2023). Wordwall is an educational web that creates various exciting and interactive learning media. The appearance and features of the Wordwall can be seen in Figure 2.

Figure 2 illustrates the features of the Wordwall, which include: Match Up, where learners pull and release each keyword to its definition; Quiz, where learners answer questions by selecting the correct answer within a set time; Random Wheel, where learners spin a wheel to receive a picture or answer related to the selected question; Missing Word, where learners fill in blank spaces in sentences or paragraphs with the correct answer; Group Sort, where learners pull each item into the correct group; Matching Pairs, where learners choose the answer according to the statement or question in the picture; Unjumble, where learners sort words or sentence boxes into the correct order; Random Cards, where learners notice the answer to a question that appears from shuffled cards; Find the Match, where learners tap the right answer repeatedly until all answers disappear; Open the Box, where learners open boxes to choose the correct answer according to the instructions; Anagram, where learners arrange letters to form the correct word; Labeled Diagram, where learners find the name of a graph or picture; Gameshow Quiz, where learners answer questions within a given time; Whac-a-mole, where learners answer questions by hitting the correct answer when it appears; True or False, where learners choose between two options to respond to a statement; Balloon Pop, where learners pop balloons that match keywords to their definitions; Maze Chase, where learners navigate a maze to reach the correct answer while avoiding enemies; and Airplane, where learners steer an airplane to the correct answer key.

The use of Wordwall in learning is one of the teaching media that can support learning in class, which can make the class more interactive, this is in line with the findings conducted by (Widhiatama & Brameswari, 2024), who state that incorporating Wordwall into the literature classroom has a significant impact on motivating students to participate in the learning environment actively and increasing their enthusiasm for reading and interpreting literary works. According to a study by (Zaharani, 2021), it was discovered that the word wall method can have a positive and significant impact on improving students' writing skills. So, it can be concluded that Wordwall game media is a digital education platform that provides interactive tools for creating educational content so that teachers can create various learning activities that students can access online. This platform can provide an interactive learning experience and fun learning, as well as provide flexibility to teachers so that teachers can customize content to suit classroom learning needs.

Research conducted by (Umam & Kowiyah, 2019) aims to describe mathematical representations based on personality types, which are divided into four personality types: artisan, idealist, guardian, and rational. Learners with A rational persona excel at recognizing and illustrating examples, characteristics, and conditions. Idealistic personality learners excel in verbal and written communication. The ability to identify and differentiate between concepts is still not proficient for the four personality types. At the same time, in terms of mathematical representation, the four personality types excel in creating visual representations using pictures and tables. The purpose of this study is different from previous studies because the focus is to measure how much impact Wordwall game media has on students' mathematical representation skills. However, the similarity is found in the research focus on students' ability to represent mathematical concepts.

Students' mathematical representation ability Plays a crucial role in establishing the foundation of mathematical understanding, skills, and problem-solving. Indonesia's need for solid mathematical representation skills is an issue that needs attention. However, the low ability to represent mathematics in Indonesia is one of the obstacles to achieving this goal. There needs to be a concerted effort to create a learning environment that is fun, interactive, and close to everyday life. The urgency of research on using Wordwall on students' mathematical representation skills is based on the importance of mathematical representation skills, the potential of Wordwall to improve these skills, and the lack of research on its effectiveness. This research can significantly improve the quality of mathematics learning in schools. Most studies have focused on the effectiveness of Wordwall in improving learning motivation and learning outcomes, with few studies specifically examining its effect on mathematical representation ability. In addition, word wall games were mainly used in literature and language lessons in previous studies. Although some studies show that Wordwall can increase student participation, we still don't know much about the aspects that can affect student engagement when using Wordwall. By addressing these gaps, future research can provide more valuable insights into how Wordwall can assist students in understanding and applying mathematical concepts more meaningfully. This study aims to assess the extent to which educational game media, specifically Wordwall, affects students' proficiency in expressing mathematical concepts.

METHOD

This research uses quantitative research with the experimental method, which aims to collect and analyze data on numbers or variables that can be measured (Ahmad et al., 2019; Wajdi et al., 2024). This study used a post-test-only control group for its design, this design was used because the researcher wants to investigate whether there is a significant effect and how much influence is given from Wordwall on students' mathematical representation skills (Fadillah et al., 2020). This research involves two groups of students, specifically the experimental group and the control group (Ardianti & Raida, 2022). Here is a table outlining the research design for this study.

Table 1. Research Design

Group	Treatment	Post-test
Control Class	X	Y_1
Experiment Class	-	Y_2

Description:

Y_1 : *Post-examination for the experimental group.*

Y_2 : *Control class post-test.*

X : Treatment utilized is the use of wordwall-based interactive media.

- : Interactive media based on Wordwall is not allowed.

For ethical considerations, Participants will be given a thorough explanation and significant details about the study's objectives before the study. To protect the privacy and safety of the participants, all information will be treated with the utmost confidentiality, and their names and identities will not be disclosed.

Respondents in this study are registered as seventh-grade students in the 2023-2024 school year at one of the public junior high schools in Jakarta because the material used is material studied in seventh grade. The sample was collected using the cluster random sampling technique. The step of selecting research subject participants is carried out where each participant is given the same opportunity to be part of the study, or the researcher does not explicitly allocate subjects into experimental or control groups (Wolfenden et al., 2021). Random selection of all VII classes, followed by VII A and VII B classes, were selected as experimental and control classes. Thirty students from class VII A were chosen as the experimental group, while 34 students from class VII B were selected as the control group for this study. In class VII-A, learning about data and diagrams has used Wordwall learning media. The researcher introduced the concept of data and diagrams briefly, then continued with interactive game activities using the Wordwall platform. In contrast, class VII-B has been taught using traditional methods and does not use Wordwall game media. The researcher teaches the concepts through lectures and class discussions, and then students will work on exercise questions related to data and diagrams.

In this study, the researcher made an essay test to be used as an assessment instrument. The researcher makes six questions based on mathematical representation ability. Furthermore, the researcher validated three experts: two math education lecturers and 1 math teacher. After revision and declared feasible, the researcher gave questions to 8th-grade students. Furthermore, the researcher processed the data using Winstep to test its validity and reliability. This study used An essay test as an instrument, and data was collected through a post-test given at the end of the lesson. This post-test assessed whether Wordwall-based interactive media affected students' mathematical interpretation ability. The post-test used in this study is an instrument in the form of a series of test questions consisting of 6 essay questions. Each question is designed to test 3 main aspects of students' mathematical representation ability, according to (Paseha & Firmansya, 2019; Taofik & Juandi, 2022) indicators of mathematical representation ability are visual representations, mathematical formulas or expressions, and written words or text.

Instrument validity measures whether the instrument being tested meets valid or invalid criteria. The validity of an instrument can accurately measure what is desired and expresses the data from the variable being studied. The validity test was carried out with the help of Winstep software, and the results of the validity test of the mathematical representation ability instrument were seen based on the MNSQ, ZSTD, and Pt values. Mean Corr.

Table 2. Validity of Rasch Model

Entry Number	OUTFIT		Pt. Mean Corr (0.4−0.85)
	MNSQ (0.5−1.5)	ZSTD (-2.0−+2.0)	
6	1.21	0.85	0.76
5	1.05	0.28	0.77
1	0.95	-0.15	0.38
2	0.84	-0.65	0.37
3	0.70	-0.43	0.53
4	0.61	-0.76	0.63

The data used in the analysis must meet at least two of the following three statistical requirements Outfit Mean Square (MNSQ) 0.5 < MNSQ < 1.5, Outfit Z-Standard (ZSTD) -2.0 < ZSTD < +2.0, Point Measure Correlation (Pt Mean Corr) 0.4 < Pt Mean Corr < 0.85 (Mumpuni et al., 2023). Based on Table 2, The final results of the instrument validity test for the variable of mathematical representation ability, using Winsteps software, are presented. There are a total of 6 validity test variable questions, and all of them will be utilized. Furthermore, an analysis is carried out to determine the person value & item reliability value. This step is essential to improve the quality of the instrument. This model is divided into two parts: the item reliability index, which aims to see the item's difficulty level. In contrast, the person reliability index aims to measure the same construct (Fitri, 2017).

Table 3. Reliability in Rasch analysis (Sumintono & Widhiarso, 2013)

Statistics	Fit Indices	Interpretation
Cronbach's alpha (KR-20)	< 0.5	Low
	0.5 - 0.6	Moderate
	0.6 – 0.7	Good
	0.7 – 0.8	High
	> 0.8	Very High
Item and Person Reliability	< 0.67	Low
	0.67 – 0.8	Sufficient
	0.81 – 0.90	Good
	0.91 – 0.94	Very Good
	> 0.94	Excellent

Cronbach alpha reliability value has 5 categories. If the value is less than 0.5, it is in the low category. If the value is between 0.5 - 0.6, it is in the moderate category. If the value is between 0.6 - 0.7, it is in the excellent category. If the value is between 0.7 and 0.8, then it is included in the high category. If the value exceeds 0.8, it is included in the very high category. Person and item reliability values have 5 categories. If the value is less than 0.67, it is in the low category. If the value is between 0.67 and 0.8, it is in the sufficient category. If the value is between 0.81 - 0.90, it is in the excellent category. If the value is between 0.7 - 0.8 then it is included in the outstanding category. If the value exceeds 0.8, it is included in the excellent category.

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-------------------------------------------------------------------------------
|          TOTAL                         MODEL         INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE   S.E.       MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN      15.9       6.0         .71     .42        .90   -.13    .89    .06 |
|  SEM        .8        .0         .13     .01        .11    .18    .11    .13 |
| P.SD       4.5        .0         .70     .06        .61   1.00    .61    .72 |
| S.SD       4.6        .0         .71     .06        .62   1.01    .62    .73 |
| MAX.      22.0       6.0        1.82     .59       2.23   1.97   2.56   2.09 |
| MIN.       6.0       6.0        -.82     .37        .16  -1.13    .14   -.71 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .46 TRUE SD     .53  SEPARATION  1.17  Person RELIABILITY  .58 |
|MODEL RMSE    .42 TRUE SD     .56  SEPARATION  1.34  Person RELIABILITY  .64 |
| S.E. OF Person MEAN = .13                                                   |
-------------------------------------------------------------------------------
Person RAW SCORE-TO-MEASURE CORRELATION = 1.00
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .62  SEM = 2.76
STANDARDIZED (50 ITEM) RELIABILITY = .94

     SUMMARY OF 6 MEASURED Item
-------------------------------------------------------------------------------
|          TOTAL                         MODEL         INFIT        OUTFIT    |
|          SCORE     COUNT     MEASURE   S.E.       MNSQ   ZSTD   MNSQ   ZSTD |
|-----------------------------------------------------------------------------|
| MEAN      84.7      32.0         .00     .18        .94   -.18    .89   -.14 |
|  SEM       8.8        .0         .27     .01        .10    .44    .09    .25 |
| P.SD      19.7        .0         .61     .03        .23    .99    .20    .56 |
| S.SD      21.5        .0         .67     .03        .25   1.09    .22    .61 |
| MAX.     111.0      32.0         .76     .23       1.34   1.50   1.21    .85 |
| MIN.      58.0      32.0        -.87     .16        .70  -1.55    .61   -.76 |
|-----------------------------------------------------------------------------|
| REAL RMSE    .19 TRUE SD     .58  SEPARATION  3.05  Item   RELIABILITY  .90 |
|MODEL RMSE    .18 TRUE SD     .58  SEPARATION  3.15  Item   RELIABILITY  .91 |
| S.E. OF Item MEAN = .27                                                     |
-------------------------------------------------------------------------------
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Figure 3. Wordwall Features

The Cronbach Alpha value, which shows the interaction between the person and the item, is 0.62, which is a sufficient level, this shows the overall suitability between the instrument used and the respondent. Then the person reliability value of 0.58 as an indicator of the consistency of the respondent's answer is a low level, this shows that the respondent's consistency in answering is low. Item reliability is 0.90, which is an indicator that the quality of items in the instrument is at a good level. This indicates that the quality of the questions used is suitable.

The research results show a descriptive display of the data collected from the mathematical representation ability test for experimental and control students.

RESULTS & DISCUSSION

The research results show a descriptive display of the data collected from the mathematical representation ability test for experimental and control students.

Result

The primary aim of this analysis is to assess central tendency, encompassing the mean, minimum value, maximum value, and standard deviation (Ratminingsih et al., 2020). A summary of the descriptive analysis of students' post-test scores is presented in Table 4.

Table 4. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Experiment	30	13	24	19.37	3.409
Control	34	12	23	17.06	3.330
Valid N (listwise)	30				

Based on Table 4, The contrast in the capacity for representation The experimental group is compared to the control group. This can be seen in the experimental class, the lowest score obtained was 13, which is higher than the lowest score of 12 in the control class. The experimental group obtained a score of 24, while the control group achieved a 23. The mean value of the experimental group is 19.37, which exceeds the average value of the control group, which is 17.06. The experimental group's standard deviation is 3.409, and the control group's standard deviation is 3.330. Classifying mathematical representation ability indicators into high, medium, and low categories (Paseha & Firmansya, 2019), To classify the score category of the components, the following standards will be used:

$x \geq (Mi + 1{,}0 \times SDi)$ = High category

$(Mi - 1{,}0 \times SDi) \leq x < (Mi + 1{,}0 \times SDi)$ = Medium category

$x < (Mi - 1{,}0 \times SDi)$ = Low Category

The formula used to determine the ideal mean (Mi) and standard deviation (SDi) is as follows:

Mi = $\frac{1}{2}$ (highest score + lowest score)

SDi = $\frac{1}{6}$ (highest score - lowest score)

Below is the classification table for the control and experimental classes:

Table 5. Experimental and control class category

Categories	Experiment Class	Control Class
High	$x \geq 20{,}33$	$x \geq 19{,}33$
Medium	$20{,}33 \leq x < 1{,}67$	$19{,}33 \leq x < 15{,}67$
Low	$x < 16{,}67$	$x < 15{,}67$

From Table 5, The categorization of the representation ability in the experimental and control classes can be determined as high, medium, or low. In the experimental class, students' mathematical representation ability is said to be high if the average score is greater than or equal to 20.33, said to be medium or medium if the average score is between 16.67 and 20.33, and said to be low if the average score is less than 16.67. While in the control class, students' mathematical representation ability is said to be high if the average score is greater than or equal to 19.33, said to be medium or medium if the average score is between 15.67 and 19.67, and said to be low if the average score is more minor than 16.67. The mathematical representation ability of control class students is said to be high if the average score is greater than or equal to 19.33, said to be medium or medium if the average score is between 15.67 and 19.33, and said to be low if the average score is more minor than 15.67. The experimental class had an average score of 19.37 in the post-test results, while the control class had an average score of 17.06. Therefore, it can be inferred that the experimental and control classes both show a moderate ability in mathematical representation.

After that, before conducting hypothesis testing, you must first conduct prerequisite analysis tests such as normality and homogeneity tests. The outcomes of the necessary examinations are as follows, which includes tests for normality and homogeneity. Since the sample in this study is included in the small sample category, namely ≤ 50, the normality test is seen from the results of the Shapiro-Wilk calculation (Budasi et al., 2020; Setyawan, 2021).

Table 6. Test of Normality Shapiro-Wilk

	Results	Statistic	df	Sig.
Mathematical Representation Ability	Experiment	0.934	30	0.62
	Control	0.948	34	0.106

From Table 6, The Liliefors test method was used to conduct normality testing. The test showed significance. The experimental group had a value of 0.62 and statistical significance. For the control group, the value of 0.106 exceeds the predetermined level of significance of 0.05. Therefore, it can be inferred that both data sets are derived from populations with a normal distribution.

After that, proceed with the homogeneity check. Homogeneity testing helps evaluate whether the variations of several populations are the same (Sianturi, 2022). The Levene test was used to conduct homogeneity checks. The post-test results of both the experimental and control classes demonstrated a normal distribution, and the following step was to conduct a homogeneity test to analyze the data. The results of the homogeneity testing are shown in the table below.

Table 7. Levene's Equality of Error Variances

		Levene Statistic	df1	df2	Sig.
Mathematical Representation Ability	Based on Mean	0.002	1	62	0.962
	Based on Median	0.015	1	62	0.903
	Based on the Median and with adjusted df	0.015	1	60.078	0.903
	Based on trimmed mean	0.001	1	62	0.980

As indicated in the table above, we get a sig value of 0.962, This indicates that the outcome is greater than the 0.05 significance level. This means that both groups of data are uniform. According to the prerequisite tests that have been conducted, the results show that the populations of the experimental and control classes have a normal and homogeneous distribution.

After that, the hypothesis is tested by conducting a t-test, this involves comparing the data from two sample groups, comparing data between the experimental group and the control group, or comparing the increase in data from the experimental group with the increase in data from a regular and homogeneous control group (Puspita & Dewi, 2021). Hypotheses are temporary responses or conjectures that must be checked for truth (Sugiyono, 2017). The hypotheses in this study are $H0$= There is no effect of using game wordwall media on students' representation skills. While $H1$= There is an effect of using game wordwall media on students' representation skills. The T-test for independent samples follows the condition that H_0 is accepted when the significance value is more significant than 0.05 and H_1 is accepted when the significance value is less than 0.05 (Sidik & Ilmiah, 2021). The test results are as follows:

Table 8. Independent Samples Test

		F	Sig.	t	df	Sig. (2-tailed)
Mathematical Representation Ability	Equal variances assumed	0.002	0.962	2.736	62	0.008
	Equal variances not assumed			2.732	60.624	0.008

From the results of hypothesis testing, A significance value of 0.008 was acquired, which is less than the significance level of 0.05. If H_0 irejected, it can be inferred that the utilization of Wordwall media has an impact on the mathematical representation abilities of students at a Junior High School in Jakarta. To find out how much influence the use of Wordwall media has, Cohen's d was used to conduct an effect size test. The following is a table of effect size frequencies according to (Cohen, 1998; Sawilowsky, 2009):

Table 9. Effect Size

Effect Size (ES)	Interpretation
$0.00 \leq ES < 0.20$	Ignored
$0.20 \leq ES < 0.50$	Small
$0.50 \leq ES < 0.80$	Medium
$0.80 \leq ES < 1.20$	Large
$1.20 \geq ES$	Huge

Based on Table 9, if the ES value is between $0.00 \leq ES < 0.20$, it is rejected because the influence given is too small. If the ES value is between $0.20 \leq ES < 0.50$, then the data has a minor influence. If the ES value is between $0.50 \leq ES < 0.80$, then the data has a medium influence. If the ES value is between $0.80 \leq ES < 1.20$, then the data has an enormous influence. If the ES value is between $1.20 \geq ES$, then the data has a considerable influence.

Table 10. Independent Samples Effect Size

		Standardizer	Point Estimate	Lower	Upper
Mathematical Representation Ability	Cohen's d	3.367	0.685	0.177	1.188
	Hedges'correction	3.408	0.677	0.175	1.174
	Glass's delta	3.330	0.693	0.170	1.207

From the effect size test results using Cohen's d, the point estimate value obtained is 0.685. When viewed from Table 9, ES of 0.685 is in the interval 0.50 - 0.80 so it can be said that the amount of influence given is at a moderate level of relationship. It is concluded that using Wordwall media moderately affects students' ability to present mathematical concepts.

Discussion

Previously there were several identifications of problems in seventh-grade students in one of the public junior high schools in Jakarta and literature review, namely students having difficulty in understanding the material in the form of mathematical images and models, learning mathematics is less attractive to students because of the lack of effective learning of mathematics such as silence and only listening to the teacher's explanation without being actively involved in learning, and lack of utilization of learning technology so that the identification of problems is limited by the problem of using wordwall-based educational games and mathematical representation skills by conducting quantitative research. This study seeks to obtain an overview of the effect of using wordwall-based educational games in learning mathematics on the mathematical representation skills of seventh-grade students.

After reviewing the research data presented, hypothesis testing and effect size testing findings indicate a "moderate" correlation between proficiency in mathematical representation and the utilization of Wordwall in mathematics learning. This aligns with the study's findings (Nisa & Susanto, 2022), which state that wordwall-based educational games strongly and positively impact students' motivation to learn math. Furthermore, the research findings are backed by studies carried out (Saputri & Dewi, 2022), which found that Utilizing the Remap Cooperative Script model with assistance from Wordwall has a positive impact on enhancing students' critical thinking abilities through learning.

The findings indicate that the use of Wordwall edugames in classroom settings can positively impact students' mathematical representation skills. Wordwall fosters an interactive educational environment and enhances students' expressive abilities. It has been demonstrated to increase student engagement and can serve as a complement to traditional classroom instruction. This is attributed to Wordwall's array of engaging educational game formats, which make learning more enjoyable and less monotonous for students. Additionally, Wordwall promotes collaboration among students and boosts their participation in the learning process, as supported by research conducted by Imanulhaq et al. (2022) and Saelan Malewa et al. (n.d.). The study observed a positive shift in students' attitudes after using

Wordwall game media. Like prior research, the use of Wordwall-based educational games represents an innovative approach to teaching mathematics.

The distinction of this study lies in its exploration of the specific factors that influence student engagement when using Wordwall, an area less examined in previous research. While numerous studies have shown that Wordwall enhances student engagement, they often overlook additional factors that contribute to this increase. By addressing these gaps, future research can offer deeper insights into how Wordwall can aid students in comprehending and applying mathematical concepts more effectively, supplemented by various supporting factors.

CONCLUSION

The findings of the study indicate differences between the experimental and control groups. Both groups were categorized as having moderate levels of mathematical representation abilities. The implementation of Wordwall game media in the learning process significantly influenced students' mathematical representation skills, with an effect size of 0.685, classified as medium. Therefore, the use of Wordwall game media in learning has proven to be effective in enhancing students' mathematical representation skills, largely due to increased student engagement during the learning process. Wordwall is a digital learning tool that provides various practical applications for both teachers and students. Ongoing research on Wordwall focuses on learning personalization, gamification, and the integration of artificial intelligence. With continuous development, Wordwall has the potential to become an even more valuable resource for educators and learners globally. As a robust educational tool, Wordwall can significantly improve classroom learning, and ongoing research and development will further enhance its utility for teachers and students alike.

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