



The Influence of Edugame Wordwall Media on Students' Ability to Solve Mathematical Problems

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ABSTRACT

The ability to mathematical problems is a crucial element in a mathematical learning process that allows learners to deepen their understanding comprehensively. Effective learning solutions are needed to overcome the various challenges that arise in this process, including the use of tools or media such as Wordwall edugame. This study aims to investigate how Wordwall educational games affect the improvement of students' abilities in solving mathematical problems. This study used a quasi-experimental research with a quantitative approach and a pretest-posttest control group design, each class consisted of 40 grade VII students selected through a stratified random sampling technique. The research utilizes a test as its measuring tool for mathematical problem-solving ability. The statistical test results revealed that using Wordwall edugame had a profound impact on enhancing mathematical problem-solving ability, with a paired sample t-test sig. value of <0.001 . After the treatment was applied, the average scores increased significantly, with the experimental class averaging from 18.85 to 53.2 and the control class from 22.83 to 41.83. The experimental class showed a significant improvement before and after the treatment, while the control class did not show a significant change in this study, indicating that using Wordwall edugame media significantly improved mathematical problem-solving ability comprehensively and effectively.

Keywords: Education game Wordwall, learning media, Mathematical problem-solving ability

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Introduction

In learning mathematics, the students receive instruction to solve various mathematical problems to understand and apply mathematical concepts in various real-life situations. Mathematics is essential not only for driving scientific discovery and technological progress but also for enhancing each student's potential to the fullest Maker (2020). In addition, learning mathematics is also very important in education because it helps students understand analytical concepts and learn how to solve problems. In mathematics, there are two types of abilities, namely hard abilities and soft abilities. When students achieve proficiency in both abilities, it will yield positive results for educational goals. Hard abilities include mathematical abilities that are directly related to the branch of mathematics. In contrast, soft abilities are abilities outside the domain of mathematics but can help and support one's success in the mathematical sciences (Darwanto, 2019). The ability to solve math problems is one of the components of hard skills.



Mathematical problem-solving ability relates to students' capacity to overcome unusual and challenging problems, Supported by essential knowledge and readiness to solve problems, this is crucial in mathematics education as it enables students to deepen their understanding and overcome various challenges effectively (Rifa'i et al., 2019). According to (Gagne, 2020), problem-solving is one of the most complex of the seven types of learning abilities and has the potential to increase one's intelligence (Kurniawati et al., 2019). The importance of student's ability to solve mathematical problems cannot be denied, especially because this ability equips them to face the future era of globalization by fostering analytical decision-making skills (Khoirunnisa et al., 2022). Consequently, being skilled in solving mathematical problems is a key competency in mathematics education. (Hermaini & Nurdin, 2020). According to NCTM, the ability to solve problems involves finding previously unknown solutions and requires students to decompose knowledge and develop new understandings of mathematics Rosydiana (2017). Furthermore, problem-solving is an attempt to overcome challenges in achieving goals that were initially out of reach. Therefore, problem-solving skills include the ability to explore, analyze information, and design effective strategies to resolve obstacles.

To support students' ability to solve the problems they face, teachers must be able to design or choose effective learning media and realize the importance of this ability(Sumartini, 2018). During observations before the research process at SMPN 228 Jakarta on mathematics learning, it was found that most students lacked enthusiasm or interest, especially in solving mathematical problems. Some factors identified as the cause of students' lack of enthusiasm include conventional learning methods that are less interactive, a learning atmosphere that is considered monotonous, and a lack of interesting elements during the learning process(Azizah et al., 2023). To aid learners in tackling challenges, teachers must proficiently design or choose suitable learning materials that acknowledge their intricacies (Sumartini, 2018).

Amidst advancing information technology and contemporary education, educational tools are crucial, particularly within the realm of mathematics education (Priyanda, 2019). The use of educational tools by educators may improve the quality and attractiveness of learning for students. Today's learning media often include technological elements, such as interactive software, mobile applications, and online platforms (Triyani, 2023). The utilization of internet-based learning tools has introduced important advances to assist students in understanding and mastering problem-solving concepts (Azizah et al., 2023).

One form of learning software that attracts attention in the field of mathematics is educational games often referred to as edugames (Juliana et al., 2022). Education games (edugames) are a type of learning medium that integrates game elements with educational goals. In the context of mathematics learning, edugames can create a fun learning experience by presenting mathematics learning materials or evaluating



math problems through game interactions, challenges, and rewards (Nisa & Susanto, 2022). Edugame Wordwall is a web-based digital learning tool that offers interactive, user-friendly, and accessible games for everyone. This wordwall not only helps in creating questions but also for evaluation in the context of digital-based learning. Wordwall is a practical, interactive learning media option. As revealed by (Pradani, 2022), using Wordwall edugame media can produce positive interactions and benefit student development.

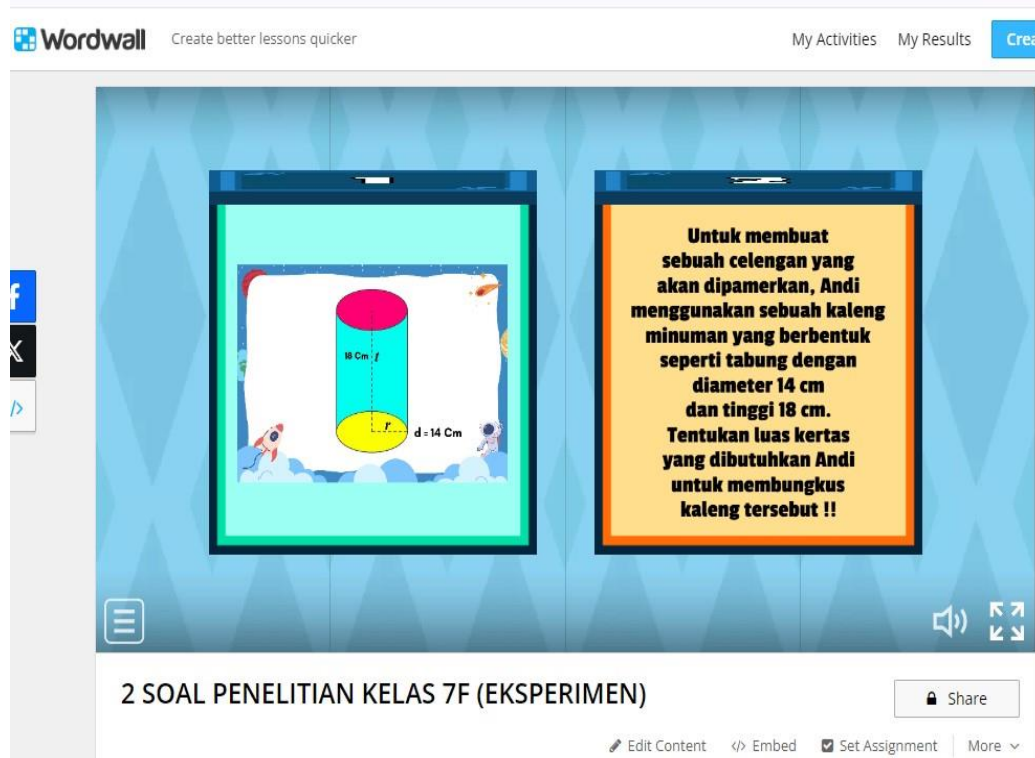


Figure 1. Display questions on edugame Wordwall using the open the box feature

Web-based edugames like Wordwall can help represent mathematical concepts through the use of interactive images and visualizations. This wordwall edugame media provides several views that can be used and changed according to the display you want to use (Nabilah & Warmi, 2023). By providing tools and features that help present images related to mathematical material, Wordwall facilitates students in grasping abstract concepts more effortlessly through vivid and appealing visual representations (Hasram et al., 2021). This not only makes learning more engaging but also helps learners in analyzing and remembering information more effectively. Not only does this app provide arcade-style games, such as Maze Chase and Airplane, but it also comes with class management tools (Gusman (2022)). Teachers can easily edit each activity, adjusting to the type of lesson and teaching style. This wordwall application provides a variety of varied features, including quizzes, random cards, crosswords, and so on (Azizah et

al., 2023). The novelty of this research lies in its focus on the ability of junior high school students to solve mathematical problems specifically related to three-dimensional geometry. Previous studies have predominantly concentrated on learning outcomes without delving deeper into students' mathematical problem-solving abilities. This study aims to fill that gap by exploring how Wordwall edugames can enhance students' problem-solving abilities in mathematics. Details of these features are in Figure 2.

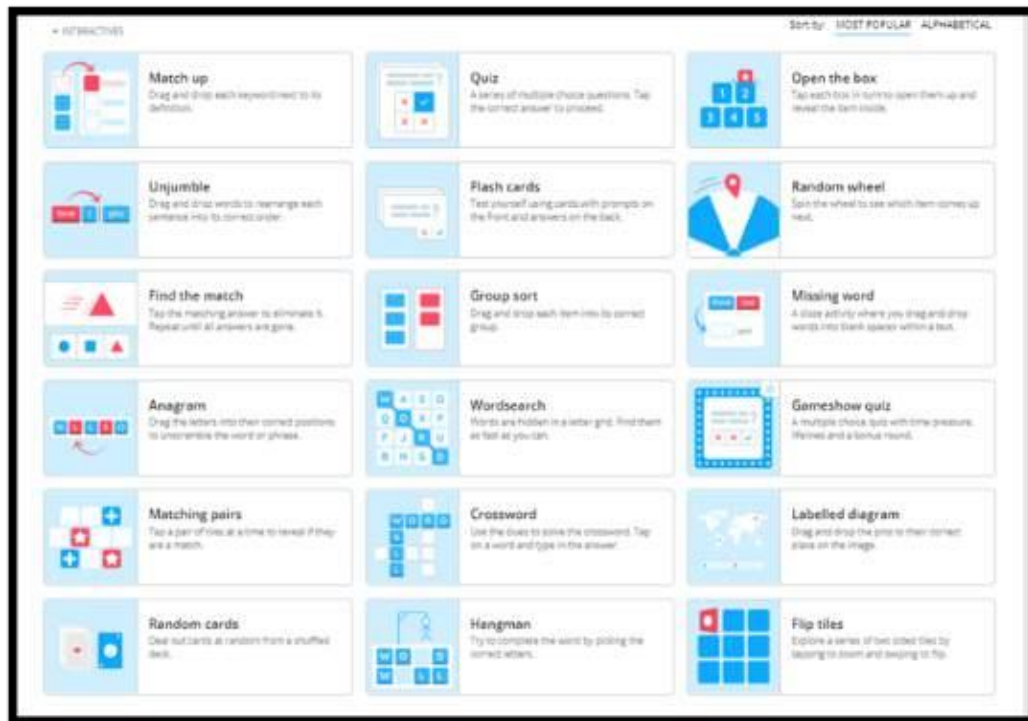


Figure 2. Display features on edugame Wordwall

Several studies have shown the advantages of using Wordwall educational games in learning mathematics. An investigation conducted by Azizah, et al (2023), demonstrated the influence of Wordwall educational games in enhancing mathematical problem-solving abilities. Additionally, Nisa & Susanto, (2022) it is concluded that utilizing the Wordwall edugame positively influences students' ability to solve mathematical problems related to spatial concepts. Triyani (2023) showed that the use of Wordwall edugame equipped with interactive props significantly improved the understanding of building space material. The use of Wordwall edugames has also proven effective in deepening students' understanding of the visualization and analysis of spatial shapes, as shown by Juliana et al., (2022).

Methods

This study used a quantitative methodology to assess the influence of Wordwall educational media on students' ability in mathematical problem-solving, aiming to measure its beneficial effect on their

mathematical problem-solving ability Abdullah, et al (2017). In this study, a quantitative experimental technique was used, using two different classes of participants, one class was selected to act as the experimental group, whereas the other was designated as the control group, Rukminingsih, et al 2020). The purposive sampling technique is the step of randomly selecting participants (subjects, populations, or samples). In other words, each participant is given the same opportunity to be part of the research Isnawan, et al (2020).

The study involved seventh-grade students from junior high schools in Jakarta during the school academic year 2023/2024. This study involved seventh grade students from SMPN 228 in Jakarta in the 2023/2024 school year. A sample of students from classes VII-E and VII-F, each consisting of 40 students, was selected using the stratified random sampling technique. In the implementation of the study, the experimental class used the Wordwall edugame to learn the material "Buildings of Space," which included a brief introduction to the concept. Meanwhile, the control class followed conventional learning with lecture and discussion methods without using Wordwall edugame media.

This study used a quasi-experimental with a pre-test and post-test assessment framework. Based on Sugiyono (2017), two classes were randomly selected using stratified random sampling technique and given an initial test consisting of 4 essay questions. The sample selection for classes 7E and 7F was adjusted to the material contained in the instrument, namely the material of building space for grade 7 SMP. The initial pre-test process aims to assess whether there is a significant difference between the experimental group and the control group at the beginning of the study. The instruments used for the pre-test and post-test in this study included 4 questions designed to measure indicators of students' mathematical problem solving ability. All instruments have been validated by expert validators and declared feasible and have gone through validity and reliability tests to ensure that the instruments are valid and reliable. If no significant difference is found between the experimental class and the control class in the initial test, the final test results can be considered valid. This research design can be depicted through the following illustration:

Table 1. Design of the research

Class	First Test	Treatment	Final Test
A1	O1	X	O2
A2	O3		O4

Description:

A1 = Experimental class randomly drawn



- A2 = The control class was taken randomly
- O1 & O3 = Pre-test are used to assess the variation influenced by two class
- O2 = Post-test mathematical problem-solving ability using Wordwall edugame
- O4 = Post-test mathematical problem-solving ability without using Wordwall edugame
- X = The upper class, which acted as the experimental group, received the treatment, while the lower class, which acted as the control group, was not given any intervention.

The instruments for the pre-test and post-test consisted of 4 questions that covered uniform spatial material. Each question in the pre-test and post-test was designed to measure the same indicators and had a consistent format, allowing for a consistent evaluation of students' mathematical problem solving ability. After going through the test instrument validation process, reliability testing is then carried out to evaluate the consistency of the instrument as an indicator of variables or constructs (Retnawati, 2017). The reliability test is as follows:

Table 2. *Instrument Reliability Results*

NO.	Statistics	Value
1	Cronbach's alpha reliability (KR-20)	0.9
2	Person Reliability	0.73
3	Item reliability index	0.76
4	Person Separation	0.70
5	Item Separation	0.59

From the findings of the measurements, Cronbach's alpha (KR-20) score is 0.9, indicating the excellent quality of the test instrument. Meanwhile, person reliability reached 0.73 and item reliability 0.76, indicating adequate test instrument quality. The higher the separation value, the better the research instrument in identifying items and groups of people Dyah Budiastuti (2018).

Results and Discussion

The research obtained from the test was then further explored to describe students' problem-solving ability before and after being given treatment in the form of education by using Wordwall edugame media. The school analyzed in this study is one of the junior high schools located in Jakarta, with a research sample of 40 students from classes VIII E and VIII F. During the study, four data sets were gathered, specifically the outcomes of pre and post-tests from both the experimental and control classes. Before implementing the Wordwall edugame learning media in the experimental class, a pre-test was conducted. In the control class, a pre-test was also conducted before any learning activities commenced, but without



the use of Wordwall edugame media. The study involved a total of 40 students, each of whom completed four essay questions. The details of the learners' pre-assessment results can be found in Table 3.

From the pre-test outcomes assessing students' mathematical problem-solving skills in both the experimental and control classes, it is evident that there are no notable differences in the maximum and average scores between the two groups. Specifically, the experimental class averaged 18.85, while the control class averaged 22.83. This shows that both groups are in equal class conditions, with no group having a particular advantage. This equal class condition ensures that the initial comparison of problem-solving ability between the two groups is not influenced by external factors, as illustrated in Table 3. After the intervention using the Wordwall edugame media, the experimental class showed a notable improvement, with an average score increase to 64. This significant enhancement can be attributed to the interactive and engaging nature of the Wordwall edugame, which potentially enhances students' understanding and retention of mathematical concepts. The use of edugames aligns with the cognitive theory of multimedia learning, which suggests that interactive elements can facilitate deeper learning (Imanulhaq & Prutowo, 2022).

However, despite the substantial improvement, the maximum score achieved by the experimental class was still not exceedingly high. This limitation could be due to the short duration of the intervention or the complexity of the problems presented in the post-test, which may require more extended practice and reinforcement. Previous research has indicated that while educational games can improve learning outcomes, their effectiveness is often contingent upon the duration and quality of their integration into the curriculum (Minarta & Pamungkas, 2022). Interestingly, the control class, which did not receive the Wordwall edugame treatment, also experienced a slight increase in their average score, although not as significant as the experimental class. This improvement could be due to natural progression in students' understanding over time and regular classroom activities. Additionally, it may reflect a placebo effect, where students' performance improves simply due to being part of a study (Hawthorne effect). The findings suggest that while the edugame provided a more substantial boost, regular classroom instruction still contributed to students' learning, consistent with findings from (Suyuti et al., 2023) on the impact of traditional teaching methods.

In conclusion, the study highlights the effectiveness of Wordwall edugame media in enhancing students' problem-solving abilities, while also acknowledging the limitations and potential influences on both the experimental and control groups' performance. Further research with extended intervention periods and varying difficulty levels of problems could provide more insights into the long-term benefits of such educational tools.



Table 3. The Description Results of the Pre-test

Data Description	Eksperimen class	Control class
Minimum score	6	13
Maximum score	33	34
Mean score	18.85	22.83
Standard Deviation	5.968	5.058

After the pre-test, the experimental class received an intervention using the Wordwall educational game, while the control class did not receive the same treatment. After the intervention, both classes took the post-test with the same number of students. The results indicated that the experimental class achieved greater maximum and mean scores than the control. Additionally, students in the experimental class demonstrated more comprehensive approaches to problem-solving. This highlights that employing the Wordwall educational game not only significantly enhances students' ability to solve mathematical problems but also improves their understanding of the subject matter. This media facilitates the attainment of learning objectives as detailed in Table 4 below:

Table 4. Description of Post-test Results

Data Description	Eksperimen class	Control class
Minimum score	40	24
Maximum score	64	46
Mean score	53.2	41.83
Standard Deviation	8.379	8.539

Mathematical Problem-solving Abilities Test Results

1. Normality test

Several tests were conducted to evaluate the effect and impact of using Wordwall to educate media on the problem-solving ability of the data.

Table 5. Normality test results Kolmogorov-Smirnov

Normality Test	Class	Statistic	df	Sig.
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Results of Mathematical Problem-solving Ability	Experiment pre-test	0.085	40	0.200
	Experiment post-test	0.148	40	0.270
	Control pre-test	0.126	40	0.110
	Control post-test	0.152	40	0.200

A normality test is a quantitative methodology employed to ascertain if the distribution of data conforms to the normal distribution (Quraissy, 2022). In the experimental class, the analysis results showed a post-test Sig. Value of 0.007, while in the control class, it was 0.089. Both significance values are greater than 0.05, indicating that the data follows a normal statistical distribution. Following the confirmation of the normal distribution, homogeneity testing will be carried out.

2. Homogeneity Test

Table 6. Homogeneity test results

		<i>Levene statistic</i>	df1	df2	Sig.
Pre-Test&Post-test Results Problem-Solving Mathematical Abilities	Based on the Mean Pretest	0.017	1	78	0.898
	Post-test	0.017		78	0.922
	Based on Median		1		
	Pre-test	0.036		78	0.850
	Post-test	0.036	78	0.975	
	Based on the median and with adjusted df		1		
	Pre-test	0.036		75.028	0.850
	Post-test	0.036	75.028	0.975	

A homogeneity test involves a statistical procedure used to determine whether there are significant differences or similarities between groups or conditions under study used. The main purpose of this test is to ensure that differences in variances do not affect the observed differences between the groups Sianturi (2022). Based on Table 1.6 (pre-test), the significance value obtained is 0.898, and from Table 5 (post-test), the significance value obtained is 0.992. This indicates that H0 is accepted, as the significance values are greater than 0.05. Therefore, it can be concluded that the difference in post-test results between the experimental and control classes is not significant, indicating that the variances are similar.

3.Hypothesis Test of Experimental and Control Class



Table 7. Paired sample Statistical T-test

		Sig.	df	Sig. 2tailed	Std. Error Difference
Pair 1	Pre-test & Post-test experiment	0.941	40	<0.001	1.844
Pair 2	Pre-test & Post-test control	0.467	40	<0.001	1.828

A paired sample t-test was conducted to determine whether there was a significant difference in the mean scores for mathematical problem-solving skills between the experimental group and the control group (Nuryadi et al., 2017). The analysis utilized SPSS version 27.0 software, ensuring the data met the criteria for normality and homogeneity of variance. The key decision-making criterion involved employing a paired sample t-test, where a two-tailed significance value below 0.05 indicated a notable difference in pre-test and post-test scores between the experimental and control groups (Permana & Kasriman, 2022).

Conclusion

Research conducted at SMPN 228 Jakarta demonstrated that using the Wordwall edugame significantly enhanced students' mathematical problem-solving abilities compared to traditional teaching methods. The experimental group, which utilized the Wordwall edugame, achieved a highest post-test score of 64.0, while the control group scored 56.0. Furthermore, the Wordwall edugame boosted students' enthusiasm and engagement during lessons, showcasing the advantages of interactive learning media. The average post-test scores also confirmed this, with the experimental group averaging 53.2 compared to the control group's 41.3. The paired sample t-test analysis revealed a two-sided significance value of less than 0.05, the use of the Wordwall edugame resulted in a good improvement in the experimental group's problem-solving ability, as shown by the statistically significant improvement in the experimental group's problem-solving ability.

This outcome aligns with previous research, which also demonstrated that edugames like Wordwall are effective in enhancing cognitive skills and mathematical comprehension through engaging and interactive learning methods. This study supports the constructivist theory, which posits that students construct knowledge more effectively through active participation and interaction. Thus, this study concludes that the positive effect of Wordwall edugame on students' math problem solving ability supports previous research and theoretical views on the benefits of interactive learning tools.



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