THE INFLUENCE OF THE DISCOVERY LEARNING MODEL BY WORDWALL MEDIA ON STUDENTS' MATHEMATICAL COMMUNICATION (RESEARCH STUDY ON CLASS VIII SEMESTER II STUDENTS OF SMP NEGERI 1 TEGAL ACADEMIC YEAR 2023/2024 ON STATISTICS MATERIAL)

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Abstract

The aim of this research is to prove the influence of the discovery learning model assisted by Wordwall media on students' skills in mathematical communication. The approach to this research is quantitative with the method used being experimental. The results of the experiment were measured using a mathematical communication ability test. Based on the results of the data analysis carried out with a significance level of 5%, the results obtained were that t count > t table, namely 3.76 > 2.02, So H_0 is rejected, which means that the discovery learning model assisted by Wordwall media has an effect on students' mathematical communication skills. However, from the results of the coefficient of determination, the magnitude of the influence given by the model is not greater than the influence given by other variables, where the difference in the magnitude of the influence given is quite large, namely the model gives an influence of 25%, while 75% is influenced by other variables. So the more important thing in efforts to improve students' mathematical communication skills is not the discovery learning model assisted by Wordwall media, but rather how to use this learning model. Educator's skills in teaching greatly influence learning outcomes because if educators have good teaching skills, then educators can provide appropriate treatment for each student's different characteristics.

Keywords: mathematical communication, discovery learning, Wordwall.

1 INTRODUCTION

Communication is an important skill for students to master in learning mathematics because in building the foundation of their knowledge, students need to use their communication skills such as listening, asking, explaining again, and working together (Paridjo in Rakhmawati, Paridjo, and Sholikhakh 2019). Aprioda et al (2021:231) view that in everyday life we cannot be separated from various problems, one of which is mathematical problems, so that to get solutions to these mathematical problems, mathematical communication abilities or skills are important because they are needed to understand existing mathematical problems and then convey ideas-ideas found based on these problems. In Permendiknas Number 22 of 2006, one of the goals of learning mathematics is so that students have the ability or skills to communicate their ideas or thoughts clearly regarding a situation through mathematical symbols, diagrams, tables, and others. Therefore, it can be concluded that mathematical communication skills are important for students to have so that students can construct their knowledge to find solutions to mathematical problems in the form of mathematical symbols, diagrams, tables, or others based on the results of their thinking. However, the results of observations carried out at SMP Negeri 1 Tegal showed that students' understanding of the questions given was inaccurate, they made errors in calculating and did not master the mathematical concepts needed to work on the questions. The facts show that students' skills in mathematical communication need to be developed. Therefore, this research aims to prove that the use of the discovery learning model assisted by Wordwall media has an effect on students' skills in mathematical communication.

The discovery learning model assisted by Wordwall media was used in this research because in research conducted by Sary (2023), the results obtained were that from 33 primary studies, overall, the application of the discovery learning model had an effect on students' skills in mathematical communication. Research by Hariyanto, Suwandono, and Ahmadi (2020) found that the use of interactive media was very helpful in improving students' skills in mathematical communication. Triyani (2023) in her research also concluded that the use of Wordwall-based interactive game media has

proven to be effective in learning mathematics. The use of Wordwall is already familiar at SMP Negeri 1 Tegal because based on observations, the school used it in the Strengthening Pancasila Student Profile (P5) Project activities so that students would more easily adapt to learning using this Wordwall media. However, it cannot be denied that there are several weaknesses in implementing Wordwall in mathematics learning, including that it can shift the focus of learning objectives to games. Therefore, the time limit for use of Wordwall will be determined or it could be said that this game is used as a distraction for each learning step so that students do not get bored. The aim of this research was to prove the influence of the discovery learning model assisted by Wordwall media on students' skills in mathematical communication which will be carried out on class VIII students in the second semester of SMP Negeri 1 Tegal in the 2023/2024 academic year on statistics material.

2 METHODOLOGY

2.1 Research Approach and Methods

The approach to this research is quantitative, namely research that requires a lot of numbers in the process. The numbers referred to in this research are data on mathematical communication ability test scores which are then analyzed to obtain conclusions, so that from the data collection process to data analysis, numbers are needed in the process.

This research was carried out using an experimental method, namely providing a certain treatment. The treatment given in this research is to carry out a discovery learning model assisted by Wordwall media for a certain class and it will be seen whether it is more influential in improving students' mathematical communication skills or not compared to the model usually used in this school, namely the scientific model. For greater clarity, the following image explains the stages of this research process.

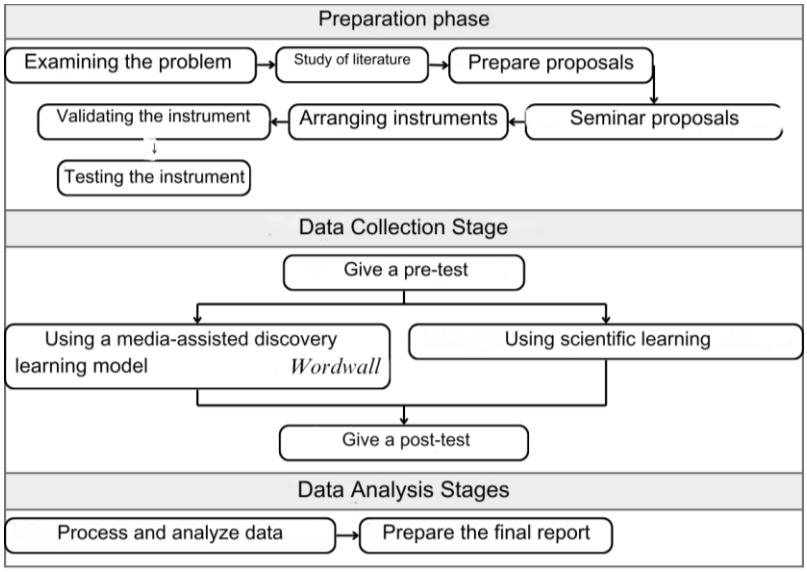

Figure 1. *Research procedure*

2.2 Research Variable

This research has the independent variable of the discovery learning model assisted by Wordwall media, while students' skills in mathematical communication are the dependent variable. The mathematical communication ability variable is a quantitative variable, namely data obtained from test results. Learning model variables are qualitative variables so that in order for data analysis to be carried out, these variables need to be converted into quantitative data. The way to convert qualitative data into quantitative data in this research is by giving the number 1 to students who received the discovery learning model assisted by Wordwall media. Meanwhile, students who did not receive this model were given the number 0, in this case it means that the student received the scientific learning model.

2.3 Population and Sample

All class VIII students of SMP Negeri 1 Tegal, even semester of the 2023/2024 academic year, totaling 252 students, are the population taken in this research. Meanwhile, the sampling in this study was

based on the direction of the class VIII mathematics teacher, namely students in classes VIII D and VIII E, totaling 44 students. Learning using the discovery learning model assisted by Wordwall media is carried out in class VIII E, while the scientific learning model is carried out in class VIII D.

2.4 Data Collection Technique

The technique used is a test technique, namely pretest and posttest in the form of a description. Test questions to measure students' mathematical communication skills use different pretest and posttest questions. The pretest questions use statistical material on data and diagrams that have been studied in class VII, the posttest questions use statistical material focusing on data which will be studied during learning using either the discovery learning model assisted by Wordwall media or the scientific model. The variations and level of difficulty of the pretest and posttest questions have been tried to be equal.

The assessment rules for testing students' mathematical communication skills refer to Cai, Lane, and Jakabcsin in Turmuzi, Wahidaturrahmi, and Kurniawan (2021) as shown in the following table.

Table 1. *Mathematical Communication Skills Test Scoring Guidelines*

Scoring Criteria	Score
The work steps are mathematically correct and complete, both in explaining the solution, in relation to a graphic model, and in relation to mathematical terms.	4
The work steps are mathematically correct but incomplete, both in explaining the solution, in relation to a graphic model, and in relation to mathematical terms.	3
Mathematical work steps have not been completed, either in explaining the solution, in relation to a graphic model, or in relation to mathematical terms.	2
Only a few mathematical steps have been taken, both in explaining the solution, related to a graphic model, and related mathematical terms.	1
Not doing work	0

Based on the mathematical communication ability assessment table, it can be seen that the better the students are at answering questions using mathematically correct steps, the higher the mathematical communication ability score obtained.

Furthermore, to ensure that the questions can measure students' mathematical communication skills and that the variation and level of difficulty of the pretest and posttest are equal, the questions need to be validated. Expert validation was carried out by one mathematics teacher and one mathematics education lecturer. The expert validation carried out by the teacher was quite good, namely paying attention to the choice of words and sentence structure needed to make the questions easy to understand according to the characteristics of the existing students. The teacher provides clear directions so that the questions can better measure students' mathematical communication skills. The result of validation by the teacher is that all questions can be used and there are revisions only in the structure of sentence writing and word usage.

However, when carrying out expert validation by lecturers, it is not satisfactory, namely only ensuring whether there is enough time to work on the questions and giving directions to consult with the teacher. Students write their own information on the validation sheet, the lecturer only signs it. So that the validation results by the lecturer are handed back to the teacher at the school where the research was conducted.

2.5 Data Analysis Technique

The analysis in this research uses dummy regression. Before using dummy regression, the data used must be normally distributed. The value data that will be analyzed is the improvement value, namely the posttest value minus the pretest. Here are the steps.

2.5.1 Prerequisite Test

First of all is the normality test. According to Sudjana and Hadi in Zulkarnain and Ritonga (2006:38), if the data is more than 30, then the data can be said to be normally distributed. Because the data in this study numbered more than 30, namely 44, the data was normally distributed.

2.5.2 Hypothesis Testing

Next is hypothesis testing. Hypothesis testing in this research uses dummy regression because the independent variable is a qualitative variable. Here's the hypothesis.

H_0: The discovery learning model assisted by Wordwall media has no effect on students' skills in mathematical communication
H_1: The discovery learning model assisted by Wordwall media influences students' skills in mathematical communication

In using dummy regression, referring to Sudjana (2001:37-39), the first step is to create a regression model as follows.

$$\hat{Y} = a + bX + \varepsilon \quad \text{Where;} \quad b = \frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{n(\Sigma X^2) - (\Sigma X)^2} \quad \text{and;} \quad a = \frac{\Sigma Y - b(\Sigma X)}{n}$$

Information:

X: Independent variable
Y: Dependent variable
n: Lots of data

Then it is tested whether the regression model can provide prediction values that describe the actual conditions well. Here's the formula.

$$R^2 = 1 - \frac{\Sigma(Y-\hat{Y})^2}{\Sigma\left(Y-\underline{Y}\right)^2} \quad ; \quad F = \frac{R^2(n-k)}{(k-1)(1-R^2)} \quad ; \quad \text{F table } (\alpha; k-1; n-k)$$

Information:

$\hat{Y}$: Predicted value ($\hat{Y} = a + bX$)
k: Many variables

With a level of significance $\alpha = 0{,}05$, the regression model can be said to be good if F count ≥ F table. After the regression model is said to be good, it is then tested whether the independent variable has an effect on the dependent variable. Here's the formula.

$$Se = \sqrt{\frac{\Sigma(Y-\hat{Y})^2}{n-k}} \quad ; \quad Sb = \frac{Se}{\sqrt{\Sigma X^2 - \frac{(\Sigma X)^2}{n}}} \quad ; \quad t = \frac{b}{Sb} \; ; \; \text{t table } (\alpha; n-k)$$

With a level of significance $\alpha = 0{,}05$, H_0 is rejected if t count ≥ t table. Or which means, the discovery learning model assisted by Wordwall media has an effect on students' mathematical communication skills if H_0 is rejected.

3 RESULTS

After carrying out the validation described in the previous chapter, a pretest was carried out in class VIII D and class VIII E to measure students' initial mathematical communication skills. After conducting a pretest in both classes, treatment was carried out. Class VIII D is given learning using a scientific model and class VIII E is given learning using a discovery learning model assisted by Wordwall media. After the treatment has been given within the specified time, a posttest is carried out to measure the students' final mathematical communication skills. The following are the test results for class VIII D students.

Table 2. *Class VIII D Test Results (Model Scientific)*

	Pretest	***Posttest***	**Difference**
Average	10,47	7,68	-2,79

Based on this table, the average pretest score obtained by class VIII D students was 10.47 with a maximum score of 16. Meanwhile, the average posttest score obtained by class VIII D students was 7.68 with a maximum score of 16. Then the pretest score increased to The posttest is obtained by subtracting the posttest score from the pretest score. Based on this table, it can be seen that the average class VIII D student experienced a decrease in score, namely -2.79 or which means that if the pretest score is 10, then the posttest score drops to 7.21. The following is a table of score groups based on student ability levels.

Table 3. *Grade VIII D Score Group*

Score Range	**Many Students**		**Information**
	Pretest	***Posttest***	
0 to 6	0	5	Low
7 to 11	14	14	Currently
12 to 16	5	0	Tall

Based on the table, there are no class VIII D students who fall into the low pretest score criteria, but quite a lot fall into the medium pretest score criteria with a total of 14 people, and 5 people fall into the high pretest score criteria. Which means that around 73.68% of class VIII D students are of medium ability and 26.32% of students are of high ability based on their pretest scores. Then for the posttest score group, there were 5 people in the low pretest score group, 14 people in the medium pretest score group, and no one in the high pretest score group. So around 26.32% of class VIII D students are low ability and 73.68% of students are medium ability based on their posttest scores. Next, here are the test results for class VIII E students.

Table 4. *Class VIII E Test Results (Discovery Learning Model Assisted by Wordwall)*

	Pretest	***Posttest***	**Difference**
Average	12,04	13,12	1,08

Based on this table, the average pretest score obtained by class VIII E students was 12.04 with a maximum score of 16. Meanwhile, the average posttest score obtained by class VIII E students was 13.12 with a maximum score of 16. Then the pretest score increased to The posttest is obtained by subtracting the posttest score from the pretest score. Based on this table, it can be seen that on average class VIII E students experienced an increase in score, namely 1.08 or which means that if the pretest score is 10, the posttest score increases to 11.08. The following is a table of score groups based on student ability levels.

Table 5. *Grade VIII E Score Group*

Score Range	**Many Students**		**Information**
	Pretest	***Posttest***	
0 to 6	1	0	Low
7 to 11	11	6	Currently
12 to 16	13	19	Tall

Based on the table, there is 1 student in class VIII E who is included in the criteria for a low pretest score, 11 people are included in the criteria for a medium pretest score, and 13 people are included in the criteria for a high pretest score. Which means that around 4% of class VIII D students are low ability, 44% of students have medium ability, and 52% of students have high ability based on their pretest scores. Then for the posttest score group, there were no students who were in the low pretest score group, 6 people were in the medium pretest score group, and 19 people were in the high pretest score group. So that around 24% of class VIII D students are of medium ability and 76% of students are of high ability based on their posttest scores.

After the increase value data has been searched, this data will be analyzed using dummy regression. However, before carrying out data analysis using dummy regression, the data must be normally distributed. According to Sudjana and Hadi in Zulkarnain and Ritonga (2006:38), if the data is more than 30, then the data can be said to be normally distributed. The data for class VIII D is 19 and VIII E is 25, so the total data is 44. Because the data in this study is more than 30, namely 44, the data is normally distributed. So data analysis can be carried out using dummy regression.

After carrying out calculations, a dummy regression model is obtained. The following is the model and its calculations.

Table 6. *Dummy Regression Model Calculation*

	Formula	**Calculation**	**Results**
b	$\frac{n(\Sigma XY) - (\Sigma X)(\Sigma Y)}{n(\Sigma X^2) - (\Sigma X)^2}$	$\frac{44(27) - (25)(-2}{44(25) - 25^2}$	3,87
a	$\frac{\Sigma Y - b(\Sigma X)}{n}$	$\frac{-26 - 3{,}87(25)}{44}$	-2,79
Model	$\hat{Y} = a + bX + \varepsilon$	$\hat{Y} = -2{,}79 + 3{,}87\ X + \varepsilon$	

Then the model is tested whether it can provide good predictive value or not. Following are the calculations.

Table 7. *Dummy Regression Model Test Calculation*

Formula	**Calculation**	**Results**

R^2	$1-\frac{\Sigma(Y-\hat{Y})^2}{\Sigma\left(Y-\underline{Y}\right)^2}$	$1-\frac{479{,}00}{640{,}64}$	0,25
F count	$\frac{R^2(n-k)}{(k-1)(1-R^2)}$	$\frac{0{,}25(44-2)}{(2-1)(1-0{,}25)}$	14,17
F table	$(\alpha; k-1; n-k)$	$(0{,}05; 2-1; 44-2)$	4,07
Conclusion	F count > F table (14,17 > 4,07)		Good model

Based on this table, the results obtained are that calculated F = 14.17 and table F = 4.07. It can be seen that F count > F table which means that the model is good at providing predictions. Next, hypothesis testing was carried out to determine the effect of the discovery learning model assisted by Wordwall media on students' mathematical communication abilities. Following are the calculations.

Table 8. *Hypothesis Test Calculations*

	Formula	**Calculation**	**Results**
Se	$\sqrt{\frac{\Sigma(Y-\hat{Y})^2}{n-k}}$	$\sqrt{\frac{479{,}00}{44-2}}$	3,38
Sb	$\frac{Se}{\sqrt{\Sigma X^2-\frac{(\Sigma X)^2}{n}}}$	$\frac{3{,}38}{\sqrt{25-\frac{(25)^2}{44}}}$	1,03
t count	$\frac{b}{Sb}$	$\frac{3{,}87}{1{,}03}$	3,76
t table	$(\alpha; n-k)$	$(0{,}05; 44-2)$	2,02
Conclusion	t count > t table (3,76 > 2,02)		Influential

The results obtained were that t = 3.76 and t table = 2.02 with a significance level of 5%, which shows that t = 3.76 and t table = 2.02 with a significance level of 5%, which shows that t = > t table so that H_0 is rejected, which means that the discovery learning model assisted by Wordwall media has an effect on students' mathematical communication skills. Then the magnitude of the influence of the discovery learning model assisted by Wordwall media on mathematical communication skills can be seen through the R2 results or also known as the coefficient of determination where the calculation process is listed in table 6. The coefficient of determination obtained is 0.25 which means that the discovery learning model assisted by Wordwall media has a 25% effect on students' mathematical communication skills, while 75% is influenced by other variables.

If we look at the results of the coefficient of determination, the discovery learning model assisted by Wordwall media only has an influence of 25% in improving mathematical communication skills, while the other variables have an influence of 75%. If we look at the learning process that was carried out during the research, it was found that students in class VIII E, which is the class that applies the discovery learning model assisted by Wordwall media, are indeed easier to manage than students in class VIII D, which is the class that applies the scientific model. Class VIII E students obeyed every direction so that starting from the beginning of the lesson, namely forming groups, then discussions, and at the end of the lesson there was a presentation, all the learning plans that the teacher had designed before teaching could be implemented well. So it is not surprising that the mathematical communication skills of class VIII E students can improve.

In contrast to class VIII D students, these students are less able to comply with every direction given. In the group discussion process, most groups have not carried out discussions well. There are even some students who just want to play and sleep in class. So the learning plan that has been designed is not implemented well. So it will be difficult to improve students' abilities, both their ability to communicate mathematically and so on. Based on the incidents found, it is clear that student characteristics have an influence and are included in one of the 75% of variables that influence students' mathematical communication skills.

Then, if we look at the initial abilities that students already have as seen from the pretest results, the average pretest score for class VIII E is higher than class VIII D, where the average pretest score for class VIII E is 12.04, while the average score class VIII D pretest was 10.47. This indicates that the initial abilities of class VIII E students are higher than class VIII D which results in class VIII E students learning faster than class VIII D. So by giving the same study time it will give different results, where the results obtained by students class VIII E will be better than the results obtained by class VIII D students. Based on this explanation, it is clear that the abilities that students have have an influence and are included in one of the 75% of variables that have an influence on students' mathematical communication abilities.

Because class VIII E students have high average abilities and are willing to comply with the directions given, class VIII E students will get better results than class VIII D students who have low average abilities and find it difficult to comply with directions. Therefore, class VIII E will get better results than class VIII D even though class VIII E does not use the discovery learning model assisted by Wordwall media, in this case using the scientific model. So, if in this research we apply the discovery learning model assisted by Wordwall media to class VIII D, we will conclude that the discovery learning model assisted by Wordwall media has no effect in improving students' mathematical communication skills. So it is clear that 75% of the other variables have a greater influence on mathematical communication skills compared to the discovery learning model assisted by Wordwall media which only has an influence of 25%.

It can be concluded that the discovery learning model assisted by Wordwall media has an effect on students' mathematical communication skills. However, the magnitude of the influence exerted by this model is not greater than the influence exerted by other variables, where the difference in the magnitude of the influence exerted is quite large, namely 25% and 75%. So the more important thing in efforts to improve students' mathematical communication skills is not the discovery learning model assisted by Wordwall media, but rather how to use this learning model. Educator's skills in teaching greatly influence learning outcomes because if educators have good teaching skills, then educators can provide appropriate treatment for each student's different characteristics.

4 CONCLUSIONS

With a significance level of 5%, the result is that t count > t table, namely 3.76 > 2.02. So H_0 is rejected, which means that the discovery learning model assisted by Wordwall media has an effect on students' mathematical communication skills. However, from the results of the coefficient of determination, the magnitude of the influence given by the model is not greater than the influence given by other variables, where the difference in the magnitude of the influence given is quite large, namely the model gives an influence of 25%, while 75% is influenced by other variables. So the more important thing in efforts to improve students' mathematical communication skills is not the discovery learning model assisted by Wordwall media, but rather how to use this learning model. Educator's skills in teaching greatly influence learning outcomes because if educators have good teaching skills, then educators can provide appropriate treatment for each student's different characteristics.

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