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Analysis of Students' Understanding of Mathematical Concepts Based on the Discovery Learning Learning Model in Algebraic Form Material

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ABSTRACT

This research was motivated by students' lack of ability to understand mathematical concepts, students also had difficulty understanding what was conveyed by the teacher in class. Therefore, the aim of this research is to analyze students' understanding of mathematical concepts based on a guided discovery learning model (Discovery Learning) on algebraic material. This research was carried out at SMPN 2 Praya Timur. The subjects of this research were class VII, while the samples used were class VII B as the control class and class VII A as the experimental class. The instruments used in this research are the Learning Implementation Plan (RPP) with the Discovery Learning learning model and a written test in the form of essay questions with material in algebraic form. This research is a quantitative type of experimental research, the form is The Non Equivalent Control Group Design. Data analysis using the t test using the separated variance formula shows the results of the t testt_hitung> t_tabel i.e 5,15>3,17then H_0 rejected. In this way, the results of this research are that the guided discovery learning model (Discovery Learning) is effective on students' ability to understand mathematical concepts at SMPN 2 Praya Timur.

Keywords: *Effectiveness, Discovery Learning, Understanding Mathematical Concepts*

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INTRODUCTION

Understanding concepts is the most important part of learning mathematics. Mathematics subjects emphasize conceptual understanding, because students will understand more about the material being taught when they understand the concept of the material being presented. Apart from that, understanding the concept also helps

students more easily answer the questions given (Yulianty, 2019) . However, the fact is that at school many students do not understand mathematical concepts.

Based on the results of initial observations carried out at SMPN 2 Praya Timur, it shows that students still have difficulty distinguishing between algebraic addition and algebraic multiplication. For example, x+xstudents answerx^2 where the answer should be 2x, this could happen because students are mistaken in understanding the material, errors in understanding this material are because students do not understand the mathematical concepts being taught. This is in accordance with (Rohana et al., 2017) Many students study mathematics but do not understand mathematical concepts, so students have difficulty understanding and cannot answer even the simplest questions .

Students' lack of understanding of a material concept can be caused by the inappropriate learning model used by the teacher. Incompatibility of the learning model used can have an impact on students' lack of understanding, therefore learning materials should be adapted to the learning model. One learning model that can help students understand concepts is a learning model that gives direction to students to discover mathematical concepts for themselves. Because by discovering mathematical concepts themselves, then the learning will be more attached to students so that students understand the concept better.

The learning model that gives direction to students to discover material concepts for themselves is the guided discovery learning model (Discovery Learning). (Asri & Noer, 2015) . The Guided Discovery Model (Discovery Learning) is a learning model that positions the teacher as a facilitator, namely by guiding students with questions, worksheets, or teaching materials and so on, for students to discover for themselves knowledge that they did not know before. (Mawaddah & Maryanti, 2016) . The Guided Discovery learning model (Discovery Learning) is a learning model that guides or directs students to work independently in understanding the material so that students can better understand the concepts. This is in accordance with Wilcolx's opinion, the guided discovery learning model (Discovery Learning) makes students actively learn on their own, that is, they are directly involved in discovering concepts, principles, and teachers encourage students to become experienced in conducting experiments that enable them to discover principles for themselves (Rohim et al., 2012) . Students' understanding of a material will be more inherent if students discover the concepts of the material themselves, so this can make it easier for students to understand the material and master mathematical concepts in algebraic form.

The learning model is useful as a guide for teachers, so that teachers can help students get ideas, information, ways of thinking and skills, as well as express their ideas. The learning model also functions as a guide for learning designers and teachers in planning teaching and learning activities (Sulisto & Haryanti, 2022) . The function of other learning models is as a guide for teachers in carrying out learning. This indicates that each model that will be used in learning determines the tools used in that learning. In the process of teaching and learning activities in schools, of course a learning model is needed that can help create, develop and improve the abilities that students must have.

The model used must of course be appropriate to student involvement in class, with the aim of making students more active in participating in the teaching and learning process. Therefore, before carrying out learning in class, a teacher must first design the learning tools that will be carried out with the aim of generating student activity in understanding concepts.

Therefore, researchers will apply the guided discovery learning model (Discovery Learning) in MTs schools to help students understand mathematical concepts in algebraic forms. So researchers are interested in conducting research with the title " Analysis of Students' Understanding of Mathematical Concepts Based on the Discovery Learning Learning Model on Algebraic Material".

RESEARCH METHODS

The approach used in this research is a quantitative approach with an experimental type of research. This research was conducted at SMPN 2 Praya Timur. The problems found at school are related to students' lack of understanding of mathematical concepts, especially algebraic material. The variables in the research are data resulting from understanding concepts using the Discovery Learning learning model (X_1). And data resulting from understanding concepts without the Discovery Learning learning model (X_2). Meanwhile, the research design used in this research is a Quasi-experiment Design in the form of The Non-Equivalent Control Group. In this design there are two classes which will be used as a control class and an experimental class. The experimental class is the class that is given treatment or learning using the Discovery Learning model, while the control class is the class that is not given treatment or without the Discovery Learning model. The experimental group was class VII A and the control group was class VII B, class VII A consisted of 21 students and class VII B had 20 students. The sampling technique in this research is a saturated sampling technique. The research design can be seen in table 2 .1.

Class	Pre-Test	Treatment	Post-Test
VII A	O_1	X	O_2
VIIB	O_3		O_4

Table 2 .1. Research design

Information:

O_1 = experimental class pre-test results
O_2 = experimental class post-test results
O_3 = control class pre-test results
O_4 = control class post-test results
X = treatment (Discovery Learning learning model).

The data collection technique used in this research is writing related to understanding mathematical concepts. There are two tests given, namely a written test related to the ability to understand the concept of set material. This test is given to both classes before being given treatment (Pre-test). The next written test is a written test

related to the ability to understand concepts in algebraic material. This test was given after treatment was given to the experimental class. The treatment given was learning using the Discovery Learning model.

Discovery Learning learning model given to the experimental class was carried out over three meetings. The implementation of this learning model is proven by the observation sheet on the implementation of the Discovery Learning learning model which is filled in by mathematics subject teachers at the school. After being given treatment to the experimental class with the Discovery Learning learning model, the subjects were then given a second written test (post-test). This test was based on algebraic material which had been prepared according to indicators of understanding mathematical concepts.

RESULTS AND DISCUSSION

Description of Research Results

Based on the research results, it was found that for algebraic material there are still many students who find it difficult and even do not understand the algebraic material at all. Most students are confused by the form of operations that use variables x, y, a, and so on, there are even some students who don't know what algebraic form is. Researchers gave a pre-test to see the initial abilities of the two classes. The pre-test results show that the initial abilities of the two classes are almost the same, this can be seen from the average value of the pre-test results, namely 17.64 for the experimental class and 18.82 for the control class.

Description of Learning Implementation Using the Discovery Learning Model

The results of observations using the observation sheet guidelines carried out by observers are used to determine the implementation of learning in the experimental class, namely the Discovery Learning model The implementation in class is as follows:

1. Stimulation (stimulation), in this case the researcher did this by giving an example, namely by showing candy, the researcher showed two candies to the students and asked how many candies were shown, then the students answered two candies. Then the researcher showed a pack of candy and asked how much candy was in one pack of candy, then the students could not answer with certainty the contents of the candy in one pack. So, to determine the total number of candies available, the researchers used an algebraic form to express the number of candies mathematically, namely x+2. xto state the number of candies in the wrapper, namely the unknown number of candies.
2. Problem statement (statement/problem identification), at this stage the researcher asked students to look for problems that were similar to the previous candy case. The researcher asked one group to identify as many existing problems as possible.
3. Data collection (data collection), the researcher directs students to collect the data they get, students can record each data they get from the opinions of each group member.

4. Data processing, after collecting data in groups, the researcher then asked students to choose which data was included in algebraic form and which was not algebraic form by discussing with group friends. In this case, there are many examples put forward by students, one of which is how much rice is in one kilo, so that the weight of one grain of rice can be determined.
5. Verification (confirmation), after discussing with group friends and choosing which is an algebraic form and which is not an algebraic form, students explain the results of the discussion with their group in front of the class. Each student is given the opportunity to explain and ask questions related to what is being discussed, namely algebraic forms.
6. Generalization (generalization), after discussing with each group and also the whole class, students concluded that the definition of algebraic form is a mathematical form that can be used to express a quantity whose exact amount is still unknown.

Description of Written Test Result Data

The lowest data obtained from the pre-test results between the control class and the experimental class was the same, namely 7.80. Thus the researcher assumes that the initial abilities of the two classes are the same. However, the lowest score for the post test results for the two classes is different, 27.80 for the experimental class and 25 for the control class. This shows that there is an increase in the post test results for both classes, but the experimental class is higher than the control class. Meanwhile, the highest data on the pre-test results for the experimental class and the control class showed the same result, namely 29.40, but the highest data on the post-test results was different. For the experimental class the highest data was 83.30 and the highest data for the control class was 50. These results show quite a significant difference between the improvement in the experimental class compared to the control class.

Amount of data for the experimental class in the pre test is 370.50 while the post test result is 1047.20. The difference between the pre test and post test shows quite a large difference. This shows a quite significant increase for the experimental class. Meanwhile for the control class, the amount of data in the pre-test was 376.40 and the amount of post-test data was 643.90. This shows that there is an increase but not higher than the experimental class. Meanwhile, the average value of the two classes, in the pre-test results, the average value of the control class was higher than the experimental class, namely 18.82 for the control class and 17.64 for the experimental class. These results show that the initial abilities of the experimental class as a whole are lower than the control class. However, the post test results showed different results, namely 49.87 for the experimental class and 32.30 for the control class. This shows that there is a significant difference between the experimental class and the control class, as well as a significant increase for the experimental class which uses the Discovery Learning learning model. while the control class without Discovery Learning provided improvements that were no better than the experimental class.

Based on the standard deviation value for the experimental class on the pre test results is 4.34 and the standard deviation on the post test results is 14. Meanwhile for the control class the standard deviation on the pre test results is 6.21 and on the post test results is 7. The standard deviation is used to knowing the value of the data distribution in a data sample and how close each individual data point is to the average value line. Meanwhile, the variance results for the experimental class in the pre-test results were 18.81 and the post-test results were 195.75. For the control class, the variance in the pre-test results was 38.64 and the variance in the post-test results was 49.15. Low variance indicates that the data points are skewed towards the mean value and between each other. Meanwhile, high variance indicates that the data points are very scattered around the mean and each other.

The description above shows an explanation of the test results carried out by students. From these results it can be seen that the difference in test results for the control class and the experimental class, the experimental class shows an increase from the pre-test results to the post-test results.

Table 3.1 Data from research on students' ability to understand mathematical concepts

Description	**Cont r ol**		**Experiment**	
	Pre-test	**Post test**	**Pre-test**	**Post test**
The number of students	20	20	21	21
Lowest data	7.80	25	7.80	27.80
Highest data	29.40	50	29.40	83.30
Amount of data	376.40	643.90	370.50	1047.20
Average	18.82	32.20	17.64	49.87
Standard deviation	6.21	7	4.34	14
Variant	38.64	49, 15	18.81	195.75

Table 3.2 Post-Test Results of Students' Understanding of Mathematical Concepts for Each Indicator

No	**Indicators of Understanding**	**Achievement of Values for Each Indicator**

	Mathematical Concepts	**Experimental Class**	**Control Class**
1	I_1	5	3.9
2	I_2	2.7	2
3	I_3	2.9	3.8
4	I_4	3,4	1.9
5	I_5	1.8	1
6	I_6	1.8	2
7	I_7	1.8	1.9

From this table it can be seen that the average value for each indicator of understanding of mathematical concepts is between the experimental class and the control class. There is a difference between the two classes, namely the experimental class got higher results.

Prerequisite Testing

1. Normality test

Before testing the hypothesis, the researcher first tested the normality of the data. This is because the normality test is a prerequisite test that must be met before using parametric statistics. The normality test is carried out to determine whether the data obtained from the field is normally distributed or not.

As for the results of the normality test using Chi square (⍺^2) can be seen in table 3.3

Table 3 .3 Normality Test Results

Class	*Chi Square* Table	*Chi Square* Calculate	Information
Experiment	31.41	0.94	Normal
Control	30.14	0.94	Normal

For the normality test results of the data from the control class, the results obtained for the Chi square value (〖⍺^2〗 _hitung) = 0.94, while for the degrees of freedom dk = n-1 and a significance level of 5%, the results obtained were (〖⍺^2〗 _tabel) = 30.14. This means 〖⍺^2〗 _hitung< 〖⍺^2〗 _tabelthen the data is normally distributed.

For the results of the normality test for data from the experimental class, the results obtained for the Chi square value (〖χ^2〗 _hitung) = 0.94, while for the degrees of freedom dk = n-1 and a significance level of 5%, the results obtained were (〖χ^2〗 _tabel) = 31.41. This means 〖χ^2〗 _hitung< 〖χ^2〗 _tabelthen the data is normally distributed.

2. Homogeneity Test

The homogeneity test is carried out to find out whether the specified groups have relatively the same variance. The results of calculating the homogeneity test using the statistical test F F_hitung= 3.98 for (dk numerator = 20) and (dk denominator = 19) at a significance level of 5%, the results obtained F_tabel= 2.16. because F_hitung> F_tabelthen the data is not homogeneous.

3. Hypothesis test

The hypothesis test used in this research is the t-test using the separated variance t test formula. This is because the number of samples n_1≠n_2and the data are not homogeneous. With degrees of freedom dk=n_1-1and dk=n_2-1divided by two, and then added with the smallest value of t. So the result is t = 5.15. Determining Testing Criteria and Drawing Conclusions.

The statistical results of the t-test show that t_hitung= 5.15 then with a significance level of 5% with the condition that dk= n_1-1is divided by two and n_2-1divided by two then dk= (20-1)/2=9.5 and (21-1)/2=10 so that the price is t_tabel= 3.17. Based on the decision criteria if t_hitung> t_tabelthen rejectH_0 and accept H_1. Thus, it can be concluded that the Discovery Learning learning method is effective in the students' ability to understand mathematical concepts at SMPN 2 Praya Timur.

Discussion

The average score for the experimental class was 49.87 while for the experimental class it was 32.20. From these results it can be seen that there are quite significant differences between the control class and the experimental class. This difference is because the experimental class uses the Discovery Learning learning model while the control class does not.

Based on the results of data analysis, results were obtainedt_hitung> t_tabel i.e 5,15>3,17thenH_0 rejected, the results of this hypothesis test show that the hypothesis which states that the guided discovery learning model (Discovery Learning) is effective in the ability to understand concepts is acceptable.

rejection H_0shows the truth of the alternative hypothesis (H_1). The statement that says that the Discovery Learning learning model is effective for the ability to understand mathematical concepts of class VII MTs students. Miftahul Ma'arif is correct and acceptable. This shows that this learning model is indeed effective for understanding mathematical concepts. Apart from that, the effectiveness of the Discovery Learning learning model is also shown by the average value for each indicator of concept understanding. From these results it can be seen that the highest indicator of understanding mathematical concepts is indicator 1 ( ). So it can be

concluded that the discovery learning model is more effective in the ability to understand mathematical concepts.

The Discovery Learning model is a learning model that provides students with the opportunity to discover information in the form of concepts and principles in a mental process, which is carried out through experimental activities so that children gain knowledge that they did not previously know, not through notification, some or all of it is discovered. Alone. This is what causes the Discovery Learning learning model to be effective in understanding concepts. This was also said by Miftahus Surur and Sofi Tri Oktavia, that Discovery learning is a learning process in which a concept is not presented in finished (final) form, but students are required to group their own learning methods in discovering concepts. (Surur et al., 2019) .

Meanwhile, understanding mathematical concepts means really understanding mathematical concepts, that is, students can translate, interpret and conclude a mathematical concept based on forming their own knowledge, not just memorizing " (Ramadhani, 2017) . This means a match between the Discovery Learning learning model and understanding mathematical concepts, where the Discovery Learning learning model itself is a model that directs students not only to memorize a problem solving procedure. Thus, this learning model is indeed effective for understanding mathematical concepts.

In line with the results of this research, research conducted by Siti Mawaddah and Ratih Maryanti in their journal entitled "Ability to understand mathematical concepts of junior high school students in learning using the guided discovery model (discovery learning)" the results of their research show that students' responses tend to agree with learning mathematics using guided discovery model (Discovery Learning) and students' ability to understand mathematical concepts in mathematics learning using the guided discovery model (Discovery Learning) as a whole is in the good category (Mawaddah & Maryanti, 2016) . This shows the effectiveness of the Discovery Learning learning model on the ability to understand mathematical concepts.

CONCLUSION

Based on the research results and discussion of the research data that has been described previously, it can be concluded that " Discovery Learning is effective on students' ability to understand mathematical concepts at SMPN 2 Praya Timur."

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