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# The Effect of Discovery Learning Model on the Ability to Understand Mathematical Concepts of Grade VII Students of SMP Negeri 1 Bengkulu City

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## ABSTRACT

This study aimed to investigate the effect of the Discovery Learning model on students' conceptual understanding. Discovery learning has been identified as a teaching model that encourages active exploration and deep understanding, which can influence both students' mathematical conceptual understanding and attitudes towards mathematics. The type of research conducted was a quasi-experimental research with a posttest- only control group design. The population in this study was all seventh-grade students of SMP Negeri 1 city of Bengkulu in the 2023/2024 school year. In this study, the Simple Random Sampling technique was used, resulting in class VII.5 being the experimental class and class VII.6 being the control class, with each class consisting of 30 students. Data analysis was carried out using an independent two-sample t-test. On the t-test for the results of the Post-Test of the two sample classes with a significance level ($\alpha = 0.05$), was obtained, indicating that there was an effect of the Discovery Learning teaching model on students' mathematical conceptual understanding ability.

***Keywords:*** discovery learning model, mathematical concept understanding ability

## INTRODUCTION

Mathematics is a field of science that plays an important role in the development of science and technology, both as a tool for the application of other fields of science and as the development of mathematics itself [1]. Mathematics is also a universal science that underlies the development of modern technology and develops human thinking power [2]. Therefore, mathematics learning is needed to equip the ability to think logically, analytically, systematically, critically, and the ability to work together [3]. So it can be interpreted that mathematics learning is considered necessary to be understood and mastered by students so that students can apply it in everyday life and solve existing problems.

One of the objectives of learning mathematics based on Permendikbud Number 22 of 2016 is to understand concepts and apply mathematical procedures in everyday life [4]. Based on the objectives of learning mathematics, the ability to understand mathematical concepts is an important foundation in solving mathematical problems related to everyday life. Thus, understanding concepts is a very important cognitive component that must be mastered by students, so that improving understanding of mathematical concepts is an important part of the mathematics learning process. To improve students' understanding of mathematical concepts is to improve the teaching and learning process[5]. Students are considered to understand the concept if they are able to define the concept, identify and give examples or non-examples of the concept, learn how mathematical concepts relate to each other to gain a better understanding, and use mathematics in

contexts outside of mathematics [6]. From this opinion, students who understand concepts well in lessons can achieve good learning achievement because they find it easier to follow lessons than students who do not understand the concept. In mathematics learning, mastery and understanding of the concepts of a material is a prerequisite for mastering the next material. This is because the concepts in mathematics are organized systematically, logically, and hierarchically from the simplest to the most complex[7]. As stated by the National Council of Teachers of Mathematics (NCTM), mathematical understanding is a very important aspect in the principles of mathematics learning [8]. If the basic concepts received by students are wrong, it is difficult to correct them, especially if they have been applied in solving mathematics problems. Strong knowledge of concepts will make it easier to improve students' procedural knowledge of mathematics[9]. The importance of understanding concepts in the teaching and learning process greatly influences attitudes, decisions and ways of solving problems. If likened, concepts are the building blocks of thinking[10]. Therefore, the ability to understand mathematical concepts is one of the important goals in learning mathematics. In reality, the objectives of learning mathematics in Permendikbud Number 22 of 2016 have not been fully achieved. The importance of the ability to understand mathematical concepts is not in line with the abilities possessed by students. As seen from the results of the Final Semester Assessment (PAS) of classes VII.5 and VII.6 of SMP Negeri 1 Kota Bengkulu in the Odd Semester of 2023/2024, many students still get scores below the Minimum Completion Criteria (KKM) set by the school, which is 75. In class VII.5 only 2 students out of 33 students achieved the KKM score with an average PAS mathematics score of 54.72. In class VII.6 only 2 students out of 31 students achieved the KKM score with an average PAS mathematics score of 51.48. This fact is reinforced by the statement obtained based on the results of observations and interviews during the Merdeka Belajar Kampus Merdeka (MBKM) activity. One of the 7th grade math teachers stated that students tend to have difficulty in solving problems that are different from the examples given by the teacher. Students are only able to solve routine types of problems that have been exemplified by the teacher and find it difficult to understand non-routine problems that require analysis such as descriptive problems. Students only memorize without applying a concept to an example or connecting between concepts.

One of the external factors that plays a major role in influencing student learning outcomes is the teacher. Teachers play a very important role in the learning process. Effective learning is learning that actively involves all students. Learning can be said to be successful and of high quality if all or most students are actively involved, both physically, mentally, and socially in the learning process [7]. One of the learning models that focuses its learning activities on students is Discovery Learning. Discovery Learning is a model that directs students to find concepts through observation or experimentation from various information or data that has been obtained [11]. Meanwhile, the Discovery Learning model is a learning approach that usually asks students to take scientific actions, observations, or experiments to find out what is happening [12]. In the Discovery Learning model, the teacher only acts as a facilitator, this model allows students to find out for themselves what is being learned and then construct knowledge by understanding its meaning. One of the advantages of the Discovery Learning model is as follows: a) encourages students to actively participate in the learning process because it allows them to think and use their abilities to find the final result; b) helps students understand the subject matter correctly because they experience the process of finding it themselves; c) increases students' interest in learning; d) allows them to transfer their knowledge to various contexts; and e) makes students learn more on their own [13]. This is supported by

previous research that the application of the Discovery Learning model in the mathematics learning process is one alternative for selecting a model that can increase the ability to understand concepts and get a positive response from students [14]. In addition, implementing the Discovery Learning model has an effect on students' conceptual understanding, which is shown that student activities during the learning process with the guided discovery model are in the very good criteria. Meanwhile, the conceptual understanding of students who use the Discovery Learning model is in the high qualification [15]. In essence, the Discovery Learning Model is a model that directs students to find their own concepts through information or data obtained through observation and experimentation. Based on the description of the statement above, it encourages the author to further examine whether there is an influence of the discovery learning model on students' conceptual understanding abilities because this Discovery Learning model is centered on students. Therefore, the author will conduct a study entitled "The Effect of the Discovery Learning Model on the Concept Understanding Ability of Class VII Students of SMP Negeri 1 Bengkulu City."

## MATERIALS & METHODS

This type of research is Quasi Experimental Design Research by looking at the results of a pretest before treatment or treatment in the form of discovery learning and a posttest after treatment. This discovery learning was conducted at SMP Negeri 1 Bengkulu City.

Inferential data analysis is used to prove the proposed hypothesis statistically and help answer the problem formulation that has been set. To determine the effectiveness of the learning approach in improving students' mathematics conceptual understanding ability, use the two independent samples t test which compares the means of two different samples.

The hypothesis is:

H0: $\mu 1 \leq \mu 2$

H1: $\mu 1 > \mu 2$

Information:

$\mu 1$ : average mathematics conceptual understanding ability of classes taught using discovery learning models

$\mu 2$ : average mathematics conceptual understanding ability of classes taught using conventional method

The basis for decision making to measure whether there is a difference in the averages of the two groups being tested is by comparing the calculated t with the t table. If the calculated t value > t table then *H*0 is rejected, but if the calculated t value < t table then *H*0 is accepted.

## RESULT

### Inferential Data Analysis Test assumptions

### Pretest data

The pretest data that has been obtained must first be tested for normality and homogeneity. Normality and homogeneity tests were carried out on the pretest learning result test data in both classes. The normality test on this data uses the Kolmogorof-Smirnov test. Normality test results can be seen in table 1.

**Table 1. Pretest Normality Test Results for Mathematics Conceptual Understanding Ability**

| Kolmogorof | Pretest | | Information |
|---|---|---|---|
| | Experiment | Control | |
| Sig. | 0.200 | 0.200 | Normal |

Based on Table 3, the sig value is 0.200 for the experimental class pretest and the control class pretest. Because the sig value is greater than 0.05, the pretest data on Mathematics Conceptual Understanding Ability for both classes is normally distributed.

The homogeneity test on this data uses the F test. The homogeneity test results can be seen in table 2.

**Table 2. Pretest Homogeneity Test Results for Mathematics Conceptual Understanding Ability**

| Statistics | Pretest | |
|---|---|---|
| | Experiment | Control |
| Variance | 94.09 | 70,413 |
| $F_{count}$ | 1.34 | |
| $F_{table}$ | 4.70 | |

Based on Table 2, the Fcount is obtained calculated, namely 1.34 which is obtained by dividing the largest variance value by the smallest variance of the data. The Ftable value obtained is 4.70. Because the Fcount value is smaller than the Ftable, the pretest data for both classes is homogeneous.

**Posttest Data**

The posttest data that has been obtained, before testing the hypothesis, first carries out a normality test and a homogeneity test, then a t test for two independent samples. Normality, homogeneity and two independent sample t tests were carried out on the posttest Mathematics Conceptual Understanding Ability test data in both classes.

The normality test on this data uses the Kolmogorov-Smirnov test. Normality test results can be seen in table 3.

**Table 3. Posttest Normality Test Results of Mathematics Conceptual Understanding Ability**

| Kolmogorov | Posttest | | Information |
|---|---|---|---|
| | Experiment | Control | |
| Sig. | 0.073 | 0.200 | Normal |

Based on Table 3, the sig value is 0.073 for the experimental class pretest and 0.200 for the control class pretest. Because the sig value is greater than 0.05, the pretest data on Mathematics Conceptual Understanding Ability for both classes is normally distributed.

The homogeneity test on this data uses the F test. The homogeneity test results can be seen in the table 4.

**Table 4. Posttest Homogeneity Test Results of Mathematics Conceptual Understanding Ability**

| Statistics | Posttest | |
|---|---|---|
| | Experiment | Control |
| Variance | 102,208 | 148.72 |
| $F_{count}$ | 3.93 | |
| $F_{table}$ | 4.36 | |

Based on Table 4, the Fcount is obtained. The calculation is 3.93 which is obtained by dividing the largest variance value by the smallest variance of the data from both classes. The Ftable value obtained is 4.36. Because the calculated Fcount is smaller than the F table, the pretest data for both classes is homogeneous. Because the normality and homogeneity tests have been fulfilled, the conditions for conducting hypothesis testing using the two independent samples t test can be carried out.

The two independent samples t test is an assumption test used in this research to see the effectiveness of the learning approach taken. The results of this hypothesis test analysis can be seen in table 5.

**Table 5. Results of the t test for two independent samples**

| Mark Information | | |
|---|---|---|
| df | t count | t table |
| | | Effective |
| 26 | 2.35 | 1.70 |

Based on data in table 5, it can be seen that the value for t calculated is 2.35. Meanwhile, the t table value itself is 1.70. Because the calculated t value > t table, H0 is rejected and H1 is accepted or the problem based learning is effective in improving the mathematical conceptual understanding of students at SMP Negeri 1 Bengkulu City.

## DISCUSSION

The study revealed a significant improvement in students' ability to understand mathematical concepts when taught using the discovery learning model compared to traditional teaching methods. Key observations from the research include higher levels of active engagement among students in the experimental group. These students explored problems, formulated hypotheses, and collaborated to find solutions, showcasing a more dynamic participation in learning activities. Posttest results further indicated that students taught using discovery learning retained mathematical concepts more effectively and applied them with greater accuracy in problem-solving tasks. Moreover, this approach fostered the development of

higher-order thinking skills, such as critical analysis, evaluation, and synthesis, as students worked to solve complex problems[16].

These findings are consistent with prior research, such as Bruner's theory of discovery learning, which emphasizes the role of active involvement in enhancing students' understanding and retention of concepts. Similarly, Muhali highlighted that guided discovery learning significantly improves conceptual learning and problem-solving skills compared to more passive instructional approaches [17], [18]. The evidence from these studies underscores the efficacy of discovery learning in promoting deeper conceptual understanding and independent learning.

However, several challenges emerged during the implementation of the discovery learning model. One notable limitation was the additional instructional time required, which posed challenges for curriculum completion. The study also identified teacher readiness as a critical factor, as effective facilitation demands strong pedagogical skills and a comprehensive understanding of mathematical concepts. Furthermore, some students struggled with the open-ended nature of discovery learning, particularly during the initial stages, suggesting the need for gradual adaptation and scaffolded support.

In conclusion, the study affirms that the discovery learning model has a positive impact on Grade VII students at SMP Negeri 1 Bengkulu City by enhancing their understanding of mathematical concepts, encouraging active engagement, and fostering critical thinking. Despite its benefits, the successful application of this approach necessitates addressing challenges related to time constraints, teacher preparedness, and student adaptation. These findings contribute to the growing body of evidence supporting discovery learning as a viable and effective alternative to traditional teaching methods.

## CONCLUSION

The results of the research show that the discovery learning is effective in improving the Mathematics Conceptual Understanding Ability of students at SMP Negeri 1 Bengkulu City.

### *Declaration by Author*

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