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The Use of Discovery Learning Model to Improve Problem Solving Ability of Students' Mathematical

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ABSTRACT

Utilization of various learning models at SMP Negeri 20 Bandar Lampung is not optimal. Yet, teachers only use conventional learning models to teach various learning materials and are more active during learning than students. This causes low students' mathematical problem-solving abilities in learning mathematics, so students get a low value. The study aimed to determine whether the mathematical problem-solving abilities of students who used the discovery learning model were better than those whose learning used conventional models in class VII students of SMP Negeri 20 Bandar Lampung. This research is a quasi-experimental design study with two groups. The data collection technique used is a test of mathematical problem-solving ability. The analysis technique in this study is a statistical technique through the t-test. The results of this study indicate that students using the discovery learning model are better than students whose learning uses conventional models on students' mathematical problem-solving abilities.

Keywords: *discovery learning; teaching model; problem solving; mathematic*

INTRODUCTION

Education is a process of socialization and cultivation through interaction with the environment, which produces complete individuals who occupy a certain status in the social structure. Educators can be interpreted as a process of changing students' behaviour so that they become human beings who can live independently and as members of society in the surrounding natural environment where individuals are different. Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential for religious, spiritual strength, self-control, personality, intelligence, noble character and the skills needed by themselves and society (Rahman et al., 2022).

Learning is very closely related to science. One type of knowledge that is important to have is mathematics. Mathematics is a source of other knowledge, so

mathematics influences the development of science and is a compulsory field of study at every level of education (Ratna, W. U., Bakti, T. E., & Tjipto, D., 2020). Learning mathematics, especially at school, is a teaching and learning process with very strong educational elements. Thus, when students have completed their education at school, students are expected to have and apply the abilities and values of mathematics in everyday life.

Mathematics is one of the subjects that must be taught starting from the elementary and tertiary education levels. However, mathematics subjects by some students are still difficult to understand. Many students also find it difficult to study without direct guidance from the teacher (Nicky, D. P., Putri, S. D., & Sugama, M., 2021). The lack of students liking math lessons is because students find it difficult to solve math problems, especially in solving problems, solving problems, and changing everyday life problems into mathematical models. One of the reasons is that students do not understand the concept of the material, so one of the objectives of learning mathematics that students, namely problem-solving abilities, must master is not fulfilled.

Based on an interview with a mathematics teacher at SMP Negri 20 Bandar Lampung, information was obtained that students were less able to solve problems on specific subjects. This happened because the students' concentration level was not optimal in participating in learning. Maybe because the model used is not suitable or the model does not motivate students so that most students are less able to solve problems. In line with this, many students think that mathematics is the most challenging subject compared to other subjects.

Previous research also revealed that students' low problem-solving abilities were also seen in the results of the daily tests for class VIII students of SMPN 15 Padang. This is because students are not directly involved in discovering concepts, so students tend to memorize formulas without understanding the concept. As a result, students tend to be unable to solve problems (Sherlyane & Ary, 2018). Another problem in mathematics education is learning that is still teacher-centred. Learning like this will cause students to be less able to dominate and work actively in the teaching process.

Teachers in learning mathematics are required to be more innovative (Reni & Ummu, 2023). Students' understanding of the material becomes the teacher's consideration in learning innovations (Budi, F., Yuyun, S. H., & Oom, 2018). Students need to be equipped with skills so that students are able to solve problems faced critically, creatively, and independently in learning.

Alternative actions to overcome these problems, one of which is through the use of learning models that are applied so that learning can be more meaningful and can make students develop students' problem-solving abilities. Learning models that are creative, innovative, and in accordance with the application of science learning are

learning based on discovery. The discovery learning model can involve learning activities that maximize all students' abilities to search and investigate systematically, critically, and logically to find their own knowledge, attitudes, and skills as a form of behavior change (Gulo, 2022).

The discovery learning model is a two-way learning model that involves students in answering questions from the teacher where students make discoveries. At the same time, the teacher guides them in the right direction and the right one (Muhammad & Nur, 2022). This opinion is the same as (Nabila, 2018). The discovery learning model is a learning process that is not given in its entirety but instead involves students in organizing and developing knowledge and problem-solving skills. The discovery learning model also arouses passion in students, provides opportunities for them to move forward according to their abilities and directs their way of learning so that students feel involved and self-motivated to learn (Regina & Oktavia, 2022).

In the application of the discovery learning model, it consists of six main steps: (1) Stimulation, starting the teaching and learning process by asking questions, encouraging reading books, and other learning activities that lead to preparation of problem solving, (2) Identifying problems, namely giving opportunities to students to identify as many problem agendas as relevant to the subject matter, then one of them is selected and formulated in the form of a hypothesis (temporary answers to problem questions), (3) Data collection, giving students the opportunity to collect as much information as is relevant to prove whether or not the hypothesis is true or not, (4) Data processing, processing data and information that has been obtained by students through discussion, observation, and so on and then interpreted, (5) Proving, namely carrying out careful examination to prove whether or not the hypothesis set earlier associated with the results of data processing, (6) Draw a conclusion that can be used as a general principle and applies to all the same events or problems, taking into account the verification results (Syah, 2017).

Some researchers show increased active learning by using the discovery learning model. The research result of Apri & Muhammad (2021) pre-cycle shows that the average result of student activity is 41.53%, while in cycle I, the percentage is 60.91% and increases by 82.89% in cycle II. Thus it can be concluded that the use of discovery learning models can increase the activeness of student learning on the theme of technological development.

Furthermore, Nurul, Stefanus & Agustina (2018), in their research, conducted in the first cycle of student success 86% and the second cycle increased to 95% with the discovery learning model. In line with that research, Sispariyanto et al. (2019) the application of discovery learning models in class IV students. The results showed an increase in the percentage of active student learning. In the first cycle, students were very active as many as 7 students (32%), active students 8 students (36%) and students

who were quite active became 7 students (32%). The increase occurred in cycle II with active students as many as 17 (77%), and active students became 5 students (23%).

Based on this explanation, the application of the discovery learning model provides opportunities for students to demonstrate their ability to solve mathematical problems. The discovery learning model is a way of learning mathematics that can help students improve their mathematical problem-solving abilities according to their abilities. Starting from the thoughts above, the problem formulation of this study is whether the mathematical problem-solving abilities of students taught by the discovery learning model are better than students taught by using conventional learning models. This study aims to determine the mathematical problem-solving ability of students whose learning uses the discovery learning model.

METHOD

The experimental design used in this research is quasi-experimental. This form of experimental design is a development of true experiment design. This design has a control group but cannot fully function to control external variables that affect the implementation of the experiment. This research begins by choosing a school, then selecting two classes to be sampled. The first class (experimental class) will learn with a covery learning model, and the second class (control class) will learn in a conventional way.

The experimental design in this study can be described as follows. For measurement in this study, the authors conducted a test while the test was an essay test with the number of questions given as many as 8 in essay form. The population in this study were all students of grade VII in the odd semester of SMP Negeri 20 Bandar Lampung, totalling 172 students. The population consisted of five classes in a homogeneous state. In this study, two classes were taken as samples, so the sampling technique was class random, namely making a lottery from the five classes by drawing two times to determine the first class. The experiment will learn with the discovery learning model of 30 students, namely class VII A, the second class (control class) will learn in the conventional way (lectures) as many as 28 students, namely class VII B.

Before this instrument was used, it was first tested by students who had received the set material. This trial aims to measure the validity of the difficulty index of discrimination and reliability. The test to test the hypothesis used in this study is a statistical technique through the t-test using SPSS. This test is carried out after the data is normal and homogeneous.

FINDINGS AND DISCUSSION

In obtaining test data for students' mathematical problem-solving abilities, a test was carried out to test their mathematical problem-solving abilities, which consisted of 10-item description questions on populations outside the study sample. The items that

have been tested are 10 descriptive questions, then tested for discriminating power. Based on the results of calculating the discriminating power of the items, there are 2 low questions and 8 questions with sufficient criteria. This study examines and analyses data to determine the use of discovery learning models on mathematical problem-solving abilities. Based on the results of calculations using SPSS, the following results are obtained.

Table 1. Normality

Tests of Normality

	METHOD	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
MARK	Experiment	.109	30	.200*	.962	30	.253
	Control	.150	28	.105	.952	28	.225

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on the SPSS output of the significant results read on Kolmogorov-Smirnov, the significance for the experimental method is 0.200, and for the control method is 0.105. Thus, the significant value of both methods is more than 0.05, so the Ho hypothesis is accepted, meaning that both data come from normally distributed populations.

Table 2. Homogeneity

Levene's Test of Equality of Error Variances[a]
Dependent Variable: MARK

F	df1	df2	Sig.
.280	2	58	.757

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + METHOD

Based on the SPSS output, the Leven's Test for Equality of variances table results show a (Significant) Sig. 0.757 where > 0.05, so it can be said that the variance between groups is significantly different. After the data meets the normality and homogeneity tests, the analysis used is the t-test with the help of SPSS. The research hypothesis can be explained in detail as follows.

The research began with a preliminary study consisting of observations, interviews, and studies of students' difficulties which were carried out in class VII C of SMP Negeri 20 Bandar Lampung and continued with interviews with teachers who teach class VII. The results of the preliminary study concluded that in the learning process, students seemed less active in participating in the learning process and found it difficult to solve mathematical problems, especially in solving problem-solving questions and changing daily life questions into mathematical models. The results of teachers' observations indicate that teachers' problem is how teachers can provide

learning materials effectively and efficiently so that students can absorb the material provided by the teacher to the fullest.

In this research, the discovery learning model to improve students' mathematical problem-solving abilities that have been made to obtain test data of students' mathematical problem-solving abilities was validated by three experts before being tested in the field. Then after validating the mathematical problem-solving ability test instrument and correcting the shortcomings and input from some of these validators, a test of mathematical problem-solving ability was carried out on class VIII students of SMP Negeri 20 Bandar Lampung. The results of the field trials were then tested for validity using the product moment correlation formula with a significant level of 5%. Of the 10 test items tested, 8 were valid because rxy $\geq$ 0.361 and two items, namely numbers 3 and 7, were invalid because rxy < 0.361.

Field tests were carried out after testing the ability to solve mathematical problems and being tested for validation. The field test phase is carried out by giving a discovery learning model to one class. At this stage, the discovery learning model is implemented in learning mathematics in class VII A of SMP Negeri 20 Bandar Lampung in the odd semester of the 2022/2023 school year, which consists of 28 students. Learning activities are carried out in six meetings or twelve hours of lessons. During learning, each group of students is given according to the steps of the discovery learning model as a means for teachers to monitor their learning outcomes. The teacher acts as a facilitator who directs learning at the beginning so that learning runs effectively according to the learning activities of the discovery learning model.

At the field trial stage, the stage that was carried out to test the effectiveness of discovery learning in improving mathematical problem-solving abilities. The experimental and control classes were given a pretest at the beginning of learning to determine students' initial mathematical problem-solving abilities. Furthermore, at the end of the lesson, a posttest is given to test the increase in students' mathematical problem-solving abilities. The results of the analysis are explained as follows.

Data on tests of mathematical problem-solving abilities on set material were obtained through pretest and posttest, which were carried out at the beginning and end of learning on that material. Hypothesis testing was carried out using the t-test with the help of SPSS.

Table 3. Pretest Score t-test

Data	T_{count}	Df	*Sig. (2- tailed)*	Note
Pretest	0,930	58	0,420	*Sig. (2- tailed)* > 0,05

Based on Table 3. it can be seen the value of Sig. (2-tailed) = 0.408 > 0.05. So it can be concluded H0 is accepted. This means there is no significant difference in the average pretest score between the mathematical problem-solving abilities of students who take part in discovery learning and those of students who take part in

conventional learning. It can be concluded that the initial abilities of the two classes are not much different or equivalent.

Table 4. Posttest score t-test

Data	T_{count}	Df	Sig. (2- tailed)	Description
Pretest	8,381	58	0,000	Sig. (2- tailed) < 0,05

Based on Table 4. it can be seen that the probability value (Sig.) is less than 0.05. This means that the null hypothesis is rejected. So it can be concluded that there is a significant difference between the mathematical problem-solving abilities of students who take part in learning with discovery learning and students who take part in conventional learning.

The data used to see whether the mathematical problem-solving abilities of students taught by the discovery learning model are better than those taught by conventional learning models are obtained from pretest and posttest results. The researchers held a meeting and then gave pretest and posttest questions to students to know the mathematical problem-solving abilities of students whose learning used the discovery learning model. The calculation results are shown in Table 5.

Table 5. Average value

Descriptive Statistics

Dependent Variable: MARK

METHOD	Means	Std. Deviation	N
Experiment	73.61	9.984	30
Control	58.79	11.318	28

Based on the data obtained in Table 5, it can be seen that the mean value in the experimental class was 73.61, while the control class was 58.79. This means a significant difference in the average pretest and posttest scores of students' mathematical problem-solving abilities following discovery learning. So it can be concluded that the mathematical problem-solving ability of students who take part in discovery learning is better than students who take part in conventional learning.

CONCLUSION

Based on the data analysis and discussion described, it can be concluded that the discovery learning model on the subject of sets for class VII students of SMP Negeri 20 Bandar Lampung is better than students whose learning uses conventional learning models on students' mathematical problem-solving abilities.

Based on the conclusions above, it is suggested that teachers use discovery learning as an alternative to improve students' mathematical problem-solving abilities in set material by paying attention to the characteristics of each student in forming discussion groups so that discussions can run actively and can achieve the expected

learning goals, and expanding the scope of research that is not only limited to students' mathematical problem-solving abilities.

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