

# APPLICATION OF DISCOVERY LEARNING MODEL TO IMPROVE STUDENTS' MATHEMATICAL PROBLEM SOLVING ABILITY ON ISLAMIC JUNIOR HIGH SCHOOL

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## ABSTRACT

It is important for students to have problem solving abilities, but in the field problem solving abilities are very low. Therefore, the aim of this research is to see an increase in students' mathematical problem solving abilities by implementing the Discovery learning model. This research was conducted at one of the Islamic junior high schools in Bandung Barat regency. This research is experimental research methods. The research sample was class VII B, totaling 18 people. The data collection technique uses tests, namely pretest and posttest with 5 test questions in the form of descriptions to determine students' mathematical problem solving abilities. The data analysis techniques used are prerequisite analysis and hypothesis testing. The results of the research are that the problem solving abilities of students whose learning uses the Discovery Learning model after being given learning are better than before being given the learning. This is shown through the results of the t test using the dependent t test which obtained a significant value (2-tailed) = 0.000. The n-gain test result was 0.5767 or 57.67%, which means that the effectiveness of implementing the Discovery Learning model in mathematics learning is in the medium category or can be interpreted as quite effective. So it can be concluded that the application of the learning model with the Discovery Learning approach can improve student problem solving and help students become more proficient in solving mathematical problem.

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## INTRODUCTION

Mathematics studies quantity, structure, space and change. Because mathematics allows for complex representation and evaluation of situations, it is a valuable tool in problem solving. The objectives of mathematics subjects in primary and secondary education are listed in the enhanced Education Unit Level Curriculum (KTSP) in the 2013 Curriculum (La'ia dan Harefa, 2021), as follows: 1) Recognize ideas in mathematics, elucidate how these ideas connect with

one another, and apply ideas or algorithms flexibly, accurately, efficiently and precisely to solve problems; Mathematics 2) Apply reasoning based on patterns and properties, perform mathematical operations to make inferences, collect data, or clarify mathematical ideas and statements; 3) Solving problems which includes understanding the problem, creating mathematical models, completing models and interpreting results; 4) Using media, tables, graphs and symbols to convey concepts and make situations or problems easier to understand; 5) Possess an appreciation for the practical applications of mathematics in daily life, this includes curiosity, enthusiasm for understanding the material as well as tenacity and self-confidence while solving problems. The learning objectives above show that problem solving skills are one of the skills that pupils need to develop in order to master mathematics. Mathematical problem solving ability is a student's capacity to apply cognitive processes to solve problems by collecting data, evaluating it, compiling a series of potential solutions, and selecting the best solution. Mathematical problem solving ability according to Sumarmo (Simanjuntak dan Sudibjo, 2019) is a process of overcoming obstacles to achieve a goal. In line with this, according to Saad and Ghani (Kurniawati et al., 2019) mathematical problem solving a prearranged procedure that needs to be followed to find a specific solution to a problem that may not be immediately found. Ruseffendi (Purnamasari and Setiawan, 2019) said that the ability to solve mathematical problem is crucial for those who want to learn more about the subject and for those who want to use it in other academic subjects and daily life.

Mathematical problem solving abilities are very important for every student because according to Branca (Eris dan Rostina, 2021) (a) The primary objective of mathematics education is to assist students in solving issues; b) The core of the curriculum is problem solving, encompassing techniques, protocols, and tactics; and c) Solving problems is a fundamental ability in the study of mathematics. Teachers need to teach problem solving strategies to students at all ability levels since it is imperative that they be able to solve mathematical problems. Students may approach challenges head-on and can stop worrying about not knowing the solution this way. When solving a problem, not only to achieve the goal, but also to think about what actions must be taken so that the problem can be solved. These actions are still sought by making observations in order to give rise to a new understanding that leads to solving the problem.

Although it is clear from the statement above that mathematical problem solving abilities are very important for students, in reality students' skills in this area are still lacking. According to Pradhini (Umam et al., 2019), Indonesians' proficiency in solving mathematical problems is still quite low, namely out of 100 students, 73 of them are at level 1, which means that most students have not yet reached level 1, which is the lowest level. According to Laila et al. (2021) in their research, the low ability of students to answer mathematical problems is not only caused by a lack of understanding the questions and their lack of mathematical problem solving abilities, but also due to students' low interest in learning. According to Rohmani et al. (2020) in his research said that students' mathematical problem solving abilities are still not optimal. If students are faced with a math problem, some students can work on math problems based on the teacher's example, but if you are given a problem different then students will experience difficulty in completing them. This shows that students' mathematical problem solving abilities are influenced by different students' cognitive abilities. This causes many students to not understand mathematical concepts well and obtain unsatisfactory learning outcomes.

Based on these problems, solutions and innovations are needed in mathematics learning, both in strategies, methods, models, or learning approaches that must be appropriate and capable of producing increased mathematical problem solving abilities. One learning model that is suitable for learning mathematics is Discovery learning. According to Marisya and Sukma (2020), the Discovery learning model is a way of learning that allows students to participate in the creation of active learning strategies by exploring and acquiring new ideas, with the goal of creating

lasting effects on their memory. According to Surur and Oktavia (2019) is a teaching approach that calls for more inventiveness from teachers when constructing scenarios and gives students the chance to solve their own issues by using concepts and principles to uncover knowledge in their minds through experimentation. According to Arends (Julaeha et al., 2022) The goal of discovery learning is to help students find and express ideas about the subjects they are studying via active learning experiences and student-centered learning procedures.

Based on the findings of experts and conditions in the field, this research will examine the application of the Discovery learning learning model in improving the mathematical problem solving abilities of class VII students at MTs Al-Furqon on the subject of Linear Equations and Inequalities in One Variable (PLSV).

## METHOD

This research uses experimental research methods, namely to see the cause and effect of a condition after being given a treatment. The implementation of this research consisted of a pretest, treatment and at the end a posttest was given. The subjects of this research were class VII students at MTs Al-Furqon with a total of 18 students. The material applied is Linear Equations and Inequalities in One Variable.

The data obtained will be processed using SPSS, the test that will be used is the Analysis 2 Dependent T-test. The first step is that the data will be processed for normality test first, after that it will be processed using the paired t-test, but if the data is not normally distributed then the Wilcoxon test will be carried out. The data processed is the result of problem solving ability questions given to students with 5 questions from 4 indicators of problem solving ability. The hypothesis to help in concluding at the end is as follows:  $H_0: \mu_1 \leq \mu_2$  The problem solving ability of students whose learning uses the discovery learning model after being given the lesson is no better or the same as before the lesson was given.  $H_0: \mu_1 > \mu_2$  The problem solving abilities of students whose learning uses the discovery learning model after being given the learning are better than before being given the learning. The Problem Solving Ability indicators quoted from Polya (Rahmawati et al., 2022) are as follows:

**Table 1.** Indicator of Problem Solving Ability

No	Indicator
1	Understand the Problem
2	Planning to Solve Problems
3	Solve the Problem
4.	Check the Results of Problem Solving

From these indicators, a scoring rubric for problem solving ability according to Pratiwi and Hidayati (2022) was created for each question as follows:

**Table 2.** Mathematical Problem Solving Ability Test Assessment Guidelines

Assessment indicators	Student responses to questions/problems	Level score
Understand the Problem	Without writing down what is known and asked	0
	Write down what is known but without writing down what is asked, or vice versa	1

Planning to Solve Problems	Write down what is known and what is asked but is not yet correct	2
	Write down what is known and what is asked appropriately	3
	Without writing down a problem solving plan at all	0
	Write down a plan to solve the problem but it is not correct	1
Solve the Problem	Write down a problem solving plan appropriately	2
	Without writing down the solution to the problem at all	0
	Implementing the settlement plan but still getting it wrong/only a little right	1
	Completed the settlement plan but got it a little wrong/half right	2
Check the Results of Problem Solving	Implement the settlement plan appropriately and correctly	3
	Without checking the process and results again	0
	Checked the process and the results came back but were not correct	1
	Checking the process and returning the results accurately and correctly	2
Total problem solving ability score		10

## RESULTS AND DISCUSSION

### *Results*

This research was conducted on class VII B students at MTs Al-Furqon Cisarua with a total of 18 students. This research took place in 7 meetings with 2 meetings for pre-test and post-test and 5 meetings for implementing learning using the Discovery Learning model. At the first meeting, students were given pretest questions to determine students' mathematical problem solving abilities before implementing learning using the discovery learning model.



**Picture 1.** Pretest

The second to sixth meetings carried out the application of learning using the discovery learning model referring to the steps of the discovery learning model, namely 1) Stimulation; 2) Problem statement; 3) Data collection; 4) Data processing; 5) Verification; 6) Generalization. During learning, students are divided into groups evenly and then LKPD is distributed to each group.



**Picture 2.** Application of the Discovery Learning Model

At the last meeting, students were given posttest questions to determine students' mathematical problem solving abilities after implementing the discovery learning learning model.



**Picture 3.** Posttest

After carrying out the pretest and posttest, then the results of the pretest and posttest were subjected to descriptive analysis. So the results of the descriptive analysis are obtained in the following table:

**Table 3.** Descriptive Analysis of Pretest and Posttest Scores

	Descriptive Statistics	
	Pretest	Posttest
<b>N</b>	18	18
<b>Mean</b>	5,55	9,72
<b>St. Deviasi</b>	1,85	1,93
<b>SMI</b>	13	13

Based on the table above, it shows that the average posttest score is greater than the pretest score. The average pretest and posttest have a fairly large difference, namely 4.17. It can be interpreted that the application of the discovery learning model can improve students' mathematical problem solving abilities.

After the pretest and posttest data have been analyzed, the next step is that the data obtained will be processed using SPSS with a 2 dependent sample analysis test. The first step will be to look at the normality test first, where if the data is normal it will be continued with the paired samples t-test, if the data is not normal it will be tested with the Wilcoxon test:

**Table 4.** Normality Test Results

Shapiro-Wilk	Statistic	Df	Sig
<i>Pretest</i>	0,876	18	0,007
<i>Posttest</i>	0,853	18	0,011

The analysis results in table one show that the pretest value was 0.007 and the posttest value was 0.011, because the aim of the normality test results was to see what test the data above would use to show that the data was not normally distributed because the results of the pretest and posttest values below 0.05, it can be concluded that the next test will use the Wilcoxon test.

**Table 5.** Wilcoxon Test Results

<i>Wilcoxon test</i>	<i>Sig (2-tailed)</i>
<i>Pretest-Posttest</i>	0,000

The results obtained from the non-parametric test, namely the Wilcoxon test, get a result of 0.000 because the hypothesis test shows data from one party, so it needs to be divided by two first,  $0.000/2 = 0.000$ , which means the result of the Wilcoxon test is less than 0.05, so it can be concluded that  $H_0$  is rejected and  $H_a$  accepted, it indicates that pupils' capacity for problem-solving while applying the discovery learning approach after being compared to when the knowledge was first acquired, it is now better.

**Table 6.** N-Gain Test

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
<b>N Gain</b>	18	0,20	0,90	0,5767	0,17905

Seen from table 6. N-Gain Test, the average N-Gain result for pretest and posttest data is 0.5767 or 57.67%, which means that the effectiveness of applying the discovery learning model in mathematics learning is in the medium category or can be interpreted as quite effective.

### **Discussions**

Based on the results of the data processing above, it shows that the application of the discovery learning model implemented in class VII B can improve students' problem solving abilities. This happens because when learning takes place students can analyze and understand the material well, students are also very active when learning takes place. In line with Khasinah (2021) opinion that an active and direct learning approach is discovery learning developed by Jerome Bruner in the 1960s, Bruner also underlined the need of learning via action. Because learning is more effective if students participate actively, not just receive knowledge passively.

Based on research results from Jana and Fahmawati (2020), it shows that the discovery learning model can improve problem solving abilities, the results are better than using conventional methods because the Discovery learning model has a favorable effect on pupils' ability to solve mathematical issues. According to Ningsih and Pramaeda (2020), in their research, the discovery learning model can increase students' interest in learning activities so that it is effectively used to improve students' mathematical problem solving abilities. In line with the

opinion of Nurhasanah et al. (2018) that the apply of the discovery learning model is able to encourage pupils should possess the ability to resolve mathematical issues by finding the solution themselves. Jana and Fahmawati (2020) explain that there are several factors that cause the use of discovery learning models to improve problem solving abilities, namely seen from the discovery learning steps. The Data Collection and Data Processing steps really support students in understanding the problem they are facing and starting to develop a plan to solve the problem. The Verification and Generalization phases support students to be able to carry out the plans that have been made and recheck the answers that students have obtained.

From the pretest and posttest results, it is evident that student capacity for problem-solving has increased using the discovery learning model. In line with the opinion of Sekarsari and Wicaksono (2023) that applying the discovery learning model in learning makes students more active, their thinking potential increases, can strengthen students' stance, can create a sense of satisfaction when they can solve problems, and more self-confidence. According to Nurdiana (2019) in his research, students who utilize the discovery learning model in their classes have higher average values for more proficiency in solving mathematical problem than pupils who do not using the model.

The advantages of using the discovery learning model are that it makes lessons more meaningful, can increase students' learning motivation, in the learning process students play an active role, encouraging students to discover their own material concepts (Prasasty dan Utaminingtyas, 2020). These advantages can have a positive influence on students. However, every advantage has its drawbacks. The disadvantage experienced by researchers during learning is that it takes a long time, making learning less than optimal and less intelligent students have difficulty finding concepts on their own. In line with the opinion of the Ministry of Education and Culture Bintoro and Purwaningrum (2020) the discovery learning model's drawbacks include the inability of children with low cognitive capacity to articulate concepts, it For many students, this is not efficient enough because it requires a lot of time, there are expectations In the discovery learning model, If educators and students continue to utilize the outdated approach, it will become disrupted. Of these shortcomings, the solution to overcome the shortcomings of the discovery learning model is, creating a structured learning process, when learning students have initial knowledge and skills, when discovering concepts students are given support by the teacher.

## **CONCLUSION**

Based on the results and discussion explained above, consequently it may be said that the application of the discovery learning model in class VII B mathematics learning material on Linear Equations and Inequalities in One Variable (PLSV) can enhance pupils' capacity to solve mathematical problems. Observed from the outcomes of the pretest and posttest that the posttest results got a higher score than the pretest score, meaning that after being using the approach of discovery learning model, it demonstrated an improvement in the pupils' capacity to solve mathematical problem. Suggestions from researchers to develop this research again include adding learning media or something else..

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