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Students' Mathematics Problem-Solving Ability Through the Application of the Discovery Learning Model in SMP Negeri 1 Belitang Mulya

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ABSTRACT
The application of Discovery Learning models has been implemented to determine the mathematical problem-solving ability of students in SMP Negeri 1 Belitang Mulya. This study uses quantitative descriptive research. This study aims to describe the Discovery Learning model towards the mathematical problem-solving ability of students. The research instrument used in the form of RPP, LKPD, observation sheets, and test papers has been adjusted to the learning model of Discovery Learning and problem-solving. Before use in learning, the research instrument has been through validation stages. The data collection technique in this study is done in class VIII.1 SMP Negeri 1 Belitang Mulya using tests and observations. The results showed the mathematical problem-solving ability of students who are in a good category is as much as 50% and 50% are in the category less. The implementation at the first meeting was quite good with an average of 45.2% and at the second meeting was well done with an average of 67.3%. The lack of mathematical problem-solving ability is influenced by some things that occur in learning. One that affects the course of the study is the Covid-19 pandemic that makes students must implement physical distancing protocol when group discussions session.

Keywords: *Application, Discovery learning, Problem-solving skills.*

1. INTRODUCTION

Education is the basis and importance of the progress of a nation [1]. Thus, it is very reasonable if the education system in Indonesia has been regulated systematically in law number 20 of 2003. As has been regulated in Law number 20 of 2003, the guidelines for the implementation of learning activity of education in Indonesia are prepared in the curriculum. In its preparation, the curriculum pays attention to several things, one of which is to pay attention to the dynamics of global development. So, it can be concluded that education in Indonesia has developed following the development of time. One example of the development of the time in education is the emergence of 4C competencies in 21st-century skills. 4C competencies consist of critical thinking and problem solving, creativity, communication, and collaboration [2].

One of the 21st-century skills is Critical Thinking and Problem Solving. In mathematical learning, critical thinking can be measured using questions that test the High Order Thinking Skills (HOTS) of the students. HOTS questions include problem-solving skills, critical thinking, creativity, and arguing skills. One of the ways to acknowledge the capacity of HOTS of students in Indonesia is to examine the results of the Program for International Student Assessment (PISA). PISA is an international study to test the ability of mathematical literacy, therefore PISA's questions test can be used to examine whether the ability of students is in high order thinking or low order thinking. PISA is held every three years internationally, and the results can be seen on the official website OECD.

The results of the 2015 PISA issued by the OECD, showed that Indonesia ranked 64th with an average score of 386 out of 75 participants countries, while the highest average score was 564 which was obtained by Singapore, and the average score of the countries that participated in the PISA was 490. Based on the data above, it can be concluded that the HOTS ability of students needs to be improved. According to Widodo, et al, the HOTS ability is related to problem-solving abilities and one of the causes of low problem-solving abilities according to the information obtained by Delyana is that students are not familiar with problem-solving questions and the lack of

students' ability to solve problems. One of the efforts to improve students' HOTS abilities is to familiarize students with problem-solving questions [3].

Problem-solving skills are useful for students to be able to understand, choose strategies and approaches in problem-solving to solve a problem. Problem-solving skills are also needed by students to develop their way of thinking [4]. To work on problem-solving questions, there are several stages that students do. Those are understanding the problem, devising a plan, carrying out the plan, and looking back [5].

To improve problem-solving abilities, it is also necessary to support appropriate learning methods to achieve learning objectives [6]. One of the learning models that can be used is Discovery Learning. The Discovery Learning model is a learning model proposed by Bruner. This learning model was chosen, because based on the research results of Haeruman, et al, the Discovery Learning model can improve students' critical thinking skills, which, of course, will be useful in problem-solving abilities [7]. In addition, the stages in the discovery learning method expressed by Shah in Mawaddah, et al. have a relationship related to the stages of problem-solving, which consist of Stimulation, Problem Statement, Data Collection, Data Processing, Verification, and Generalization [8].

This application will be carried out at SMPN 1 Belitang Mulya because, based on data obtained from teachers at the school, during learning, they rarely use problem-solving questions and for several years this school has not participated in Olympic events or competitions in the field of mathematics. This study aims to determine the implementation of the Discovery Learning model and the problem-solving abilities of students after the Discovery Learning model is applied.

2. METHOD

This research uses descriptive quantitative research. This study aims to describe the Discovery Learning model in learning on students' mathematical problem-solving abilities. The variable in this study was the students' mathematical problem-solving ability after the Discovery Learning model was applied. Problem-solving ability is students' skill to find solutions to problem-solving problems. In this study, the problem-solving ability of students at SMPN 1 Belitang Mulya was measured based on student test results after the Discovery Learning model was applied. The assessment of problem-solving abilities uses four indicators based on Polya strategies, namely understanding the problem, making plans, carrying out plans, and looking back. The subjects in this study were students in class VIII.1 of SMP Negeri 1 Belitang Mulya. This research will be carried out in the even semester of the 2020/2021 academic year at SMP Negeri 1 Belitang Mulya.

2.1. Research Procedure

This study through three stages, namely the preparation stage, the implementation stage, and the data analysis stage. The preparatory stages that will be carried out are making a research design, compiling research instruments, and managing research permits. The next stages of implementation that will be carried out are researching the class chosen as the subject, carrying out treatment in the class using the Discovery Learning, and giving a test in the form of a description of the question after the treatment. Then the third stage that will be carried out is processing the data, analyzing the data obtained and compiling the research results.

2.2. Data Collection

The process carried out in data collection is by conducting tests. The test is essay questions to measure students' mathematical problem-solving abilities after using the discovery learning model. In this study, the type of observation used is participatory observation. Observations were made on class VIII.1 students' at SMP Negeri 1 Belitang Mulya to assess the implementation of learning. Observations are used to support the test results of mathematical problem-solving abilities. Through participatory observation, the data obtained is complete, sharp, and knows the meaning of visible behaviour.

2.3. Data Analysis

Processing data in this study using simple statistical analysis. Simple statistical analysis to calculate the percentage and average of the data that has been obtained. The results of data processing will draw conclusions based on predetermined standards or criteria [9]. The ability of students' are analyzed from tests is done. After the test will produce a score from each student. The scores will be summed and analyzed. The steps to be taken are as follows:

2.3.1. Convert Point into Score

Test results obtained by calculating the scores obtained by students with this formula below: [10]

$$score = \frac{Obtained\ Point}{Maximum\ Point} \times 100$$

2.3.2. Determining the Category of Student Ability

After students' scores are obtained, students will be categorized mathematical problem-solving abilities. Students problem-solving category's is grouped as in the table below [11]

Table 1. Category of student problem solving ability

Student Scores	Rating Category
81 - 100	Very good
61 - 80	Good
41 - 60	Enough
21 - 40	Not enough
0 - 20	Very less

2.3.3. Determining the Percentage of Students in Each Assessment Category

To determine the percentage in each category, the following formula below can be used:

$$percentage = \frac{Many\ students\ in\ category-i}{Many\ students\ take\ the\ test} \times 100\%$$

2.3.4. Determining Average Score

The average value can be obtained by the following formula:

$$average = \frac{The\ total\ score\ of\ the\ test\ takers}{number\ of\ test\ takers}$$

2.3.5. Determining the Percentage of Students Who Meet the Problem-Solving Indicator

In determining the percentage of students who meet problem-solving indicators, you can use the following formula:

$$percentage = \frac{Many\ students\ in\ indicator-i}{Many\ students\ take\ the\ test} \times 100\%$$

2.4. Observational Data Analysis

Student observation data were analyzed based on the results of observations on the implementation of the Discovery Learning model. After observation, the percentage of each descriptor will be obtained. The steps taken in analyzing the results of the observations of each of these descriptors are as follows:

2.4.1. Put a Checkmark

Put a checkmark in the column (M) for descriptors that appear, or a checkmark in the column (TM) for descriptors that do not appear

2.4.2. Determine the Percentage of Each Category

Then the results of observations obtained from research can be categorized as follows in formula [12]:

$$percentage = \frac{Many\ students\ in\ category-i}{Many\ students\ take\ the\ test} \times 100\%$$

2.4.3. Determine the Implementation Category

Then the results of observations obtained from research can be categorized as follows [12].

Table 2. Category of discovery learning implementation

Execution (%)	Category
80.1 - 100	Very good
60.1 - 80	Good
40.1 - 60	Enough
20.1 - 40	Not enough
0 - 20	Very less

3. RESULT

3.1. Data of Mathematical Problem-Solving Ability Test Results

After carrying out the research, we acquired the data test results of the problem-solving ability of the students in SMPN 1 Belitang Mulya. The data of Mathematical problem-solving ability of students in Class VIII.1 SMPN 1 Belitang Mulya obtained through a mathematical problem-solving test carried out at the third meeting on Wednesday 5 May 2021. The implementation of this test was followed by 12 students consisting of five male students and seven female students. Below is a data result of the mathematical problem-solving ability of students in class VIII.1 SMPN 1 Belitang Mulya:

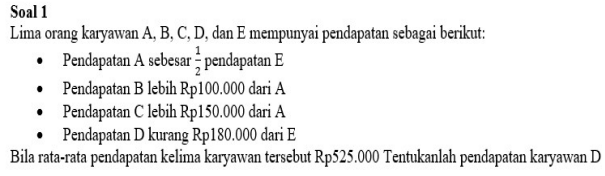
Table 3. Data on Student Ability Test Results

Student scores	Frequency of Students
81-100	0
61-80	0
41-60	6
21-40	6
0-20	0

As seen in table 3 is the number of students getting scores in a certain range of scores. In the table presented, of all the test takers, six students scored in the range of 21-40, and six students scored in the range of 41-60.

The test given is in the form of a problem-solving description of statistical material as many as two questions and is a non-routine question to measure students' mathematical problem-solving abilities. Each question is made by fulfilling four problem-solving indicators with a score of three points for each indicator, thus each question has a maximum score of 12 points. Correction of answers to questions that have been done by students is carried out according to the indicators of

problem-solving abilities. Then, the scores that have been obtained by students will be converted into scores according to the assessment guidelines. The following is an example of the answers of students who have done test number one:


Soal 1
Lima orang karyawan A, B, C, D, dan E mempunyai pendapatan sebagai berikut:
- Pendapatan A sebesar $\frac{1}{2}$ pendapatan E
- Pendapatan B lebih Rp100.000 dari A
- Pendapatan C lebih Rp150.000 dari A
- Pendapatan D kurang Rp180.000 dari E

Bila rata-rata pendapatan kelima karyawan tersebut Rp525.000 Tentukanlah pendapatan karyawan D

Figure 1 Test question number 1

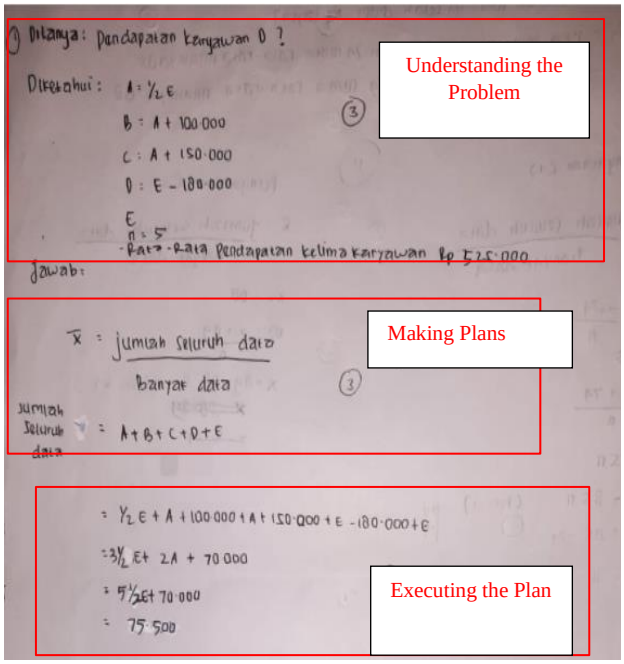


Figure 2 One of the students' answers to test number 1

Seen in Figure 2 is the answer to the number one test question of one of the students who have met the category in understanding the problem and making plans. The student has also changed the known information into the form of a mathematical model. Furthermore, in preparing the plan, it is seen that the student seeks first the sum of all the data. In the early stages of implementing the plan, the student has succeeded in making substitutions to determine the amount of all data, but then made an error in calculating, so that the completion of compiling the plan could not be completed. In the end, the student only gets full points on the indicators of understanding the problem and implementing the plan.

Furthermore, the following is an example of student answers on test number two

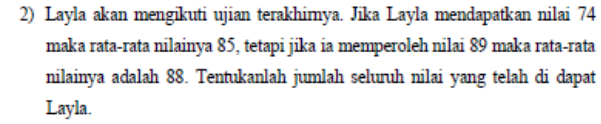

2) Layla akan mengikuti ujian terakhirnya. Jika Layla mendapatkan nilai 74 maka rata-rata nilainya 85, tetapi jika ia memperoleh nilai 89 maka rata-rata nilainya adalah 88. Tentukanlah jumlah seluruh nilai yang telah di dapat Layla.

Figure 3 Test question number 2

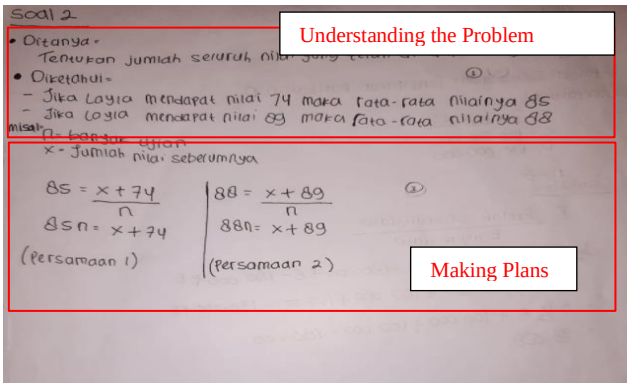


Figure 4 One of the students' answers to test number 2

Figure 4 is the result of the answer to question number two by one of the students. As seen in the picture, the student has been able to understand the problem in question and can make plans to be used in solving it. At the planning stage, the student succeeded in converting the information in the question into a mathematical model, thus obtaining two equations. However, they did not continue to carry out the plan, so in question number two the student only got full points at the stage of understanding the problem and making plans.

After doing the calculations, it found that the average value of the overall class VIII.1 student of SMPN 1 Belitang Mulya who took the test was 39.9 so it was included in the category of lacking in mathematical problem-solving abilities.

The following is the percentage of students who meet the indicators of mathematical problem-solving abilities which are presented in the table below:

Table 4. Achievement of students' mathematical problem-solving ability based on indicators

Question Number	Indicator Percentage (%)			
	Understanding the Problem	Making Plans	Executing the Plan	Looking back
1	100	75	0	0
2	83,3	50	0	0

Based on the table above, the high percentage of students' abilities in the two questions is the ability to understand the problem. Then at the stage of preparing a plan on question number one, most of the students have succeeded in fulfilling the indicators of preparing a plan. As for question number two, only half of the students can meet the indicators of planning. Then on the indicators of

carrying out the plan and looking back at the two questions, all students have not been able to meet the two indicators

3.2. Description of Observation Data

Observations were made to obtain data on the results of the implementation of the Discovery Learning model during the learning process. Observations were made at each meeting. In this study, observations were carried out by one observer by placing a checkmark on the descriptor that appeared.

Table 5. Results of observation of the implementation of the discovery learning model

Descriptor	Percentage (%)	
	Meeting 1	Meeting 2
D1	91,6	100
D2	41,6	58,3
D3	0	0
D4	58,3	58,3
D5	75	100
D6	33,3	100
D7	16,6	54,5
Average performance	45,2	67,3

Descriptor Description:

1. D1 = Students pay attention to the stimulus that the teacher gives
2. D2 = Students observe examples of phenomena related to learning materials in the classroom
3. surrounding environment
4. D3 = Students in groups looking for information on learning materials from
5. various sources such as on the internet or other books
6. D4 = Students communicate (express opinions) in
7. group discussion.
8. D5 = Students in groups conduct experiments according to the instructions in
9. LKPD
10. D6 = Students in groups answer the questions contained in the
11. LKPD
12. D7 = Students in the group process the data from the experimental results into LKPD and conclude

Based on the results of the observations, at the first meeting, an average score of 45.2% was obtained, which showed that the implementation of the Discovery Learning model was going quite well. At this first meeting, the 3rd descriptor did not appear. Then at the first meeting, the 6th and 7th descriptors were still lacking, because students were not used to working on problem-solving questions. So that in solving it, the teacher had to provide assistance that can stimulate students to make a solution. At this first meeting, the teacher also noticed that in each group not all members delivered or contributed to the discussion. This happened because the group only consisted of two members and also the pandemic conditions that required carrying out the Physical Distancing protocol. So, it affected the sitting position in the group which became slightly more space.

Furthermore, at the second meeting, the results of observations with an average implementation of 67.3% showed that the implementation at the second meeting was in a good category. It can be seen in the table that almost all descriptors have increased in implementation. Only the 3rd and 4th descriptors did not increase due to the same cause as the first meeting. The implementation of the highest descriptors that occurred in the second meeting was seen in the 5th and 6th descriptors. This shows that students have begun to understand how to solve problem-solving questions with the experience of the first meeting.

4. CONCLUSION

Based on the results of the study in class VIII.1 SMPN 1 Belitang Mulya with the application of the Discovery Learning model, in the implementation of the first meeting, the results of observations showed quite well with an average implementation of 45.2%. The implementation on the second day increased so that it was included in a good category with an average implementation of 67.3%. Then the results of the tests carried out showed mathematical problem-solving abilities were in the less category with an average score of 39.9 of the 12 students who took the test.

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