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Influence of Problem Based Learning Model on Students' Mathematical Reasoning Ability

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Abstract

The study aimed to determine the effect of problem-based learning models on students' mathematical reasoning abilities. The study used an experimental method with a quasi-experimental design and a posttest-only control design. The population was all classes in VIII grade at MTs Negeri 3 Mempawah in the 2019/2020 school year. The samples were students of VIII C and VIII A grades and were drawn using simple random sampling. Data collection techniques and tools were measurements that used an essay test contained indicators of mathematical reasoning abilities. After being tested in the two samples, data analysis was then carried out to test the hypothesis. Before testing the hypothesis, first, a prerequisite test was carried out, namely the normality test. Because the data are normally distributed, to test the hypothesis we used the t-test. It was obtained that $t_{count} = 11.15$ and $t_{table} = 1.99$ with $\alpha = 0.05$. Because of the value of $t_{count} > t_{table}$, it can be concluded that the problem-based learning model affects students' mathematical reasoning abilities.

Keywords: Problem based Learning, Mathematic, Reasoning Ability

INTRODUCTION

Mathematical reasoning ability is one of the thinking skills that must be mastered by students. It is in line with the National Council of Teachers of Mathematics (NCTM: 2000), which stated that the mathematics learning process must meet standards consisting of problem-solving, reasoning and proof, communication, connection, and representation. Besides, Soedjadi (2000) also stated that mathematics is the knowledge that uses logical reasoning and deals with numbers.

In mathematics learning objectives and process standards expressed by NCTM (2000) are in line with the mathematics learning objectives stated by the National Education Standards Agency (BSNP: 2006) that in carrying out mathematical manipulations in making generalizations, compiling evidence or explaining mathematical ideas and statements, then In doing this, students must have and be able to use their reasoning abilities. "Reasoning is a thought process that seeks to link known facts to a conclusion" Keraf (Sadiq: 2004). Therefore, to achieve the objectives of learning mathematics, one of the abilities that must be mastered by students is mathematical reasoning abilities.

To determine the reasoning abilities possessed by students at this time, researchers conducted

interviews with mathematics teachers, namely Mr. Aswandi, S.Pd. It was found that the students' reasoning abilities in learning mathematics were still very low. Students have difficulty reasoning because, in the learning process, the teacher dominates the learning. Only a few students play an active role in asking and answering questions given by the teacher. Meanwhile, less active students only listen and take notes. It is in line with research conducted by Indriani (2018) and Isnaeni (2018), stated the difficulty of students in solving mathematical reasoning ability problems was caused by a lack of understanding of concepts, understanding questions, and students' difficulties with reasoning abilities are on indicators using patterns and relationships. To analyze a mathematical situation, draw a generalized analogy. Therefore, if you see the situation experienced by the shiva, it should not happen.

To avoid these results, the teacher must play an active role in choosing a learning model to involve students more actively in the learning process. One learning model that can be applied by teachers is problem-based learning. Duch (in Sumartini: 2015) defined that problem-based learning is a learning approach with the characteristics of using real problems as a context for students to learn critical thinking, problem-solving skills and gain knowledge of the essence of learning materials. Arends (Ario: 2016) stated problem-based learning is not designed to help teachers convey large amounts of information to students. Problem-based learning is designed primarily to help students develop thinking skills, problem-solving skills, and intellectual skills. Based on this opinion, it can be seen that problem-based learning requires students to be active in participating in learning. By forming groups, students can discuss with their friends in solving problems. Students will share information related to information obtained based on the facts obtained. Thus, researchers' desire emerged to conduct research entitled "The Effect of Problem Based Learning Models on Students' Mathematical Reasoning Ability."

METHOD

The study aimed to determine whether students who were given action with problem-based learning models affected their mathematical reasoning abilities. Therefore, to answer these objectives, the method used in this study was an experimental method with a quasi-experimental design (Sugiyono2017).

The study used Posttest-Only Control Group Design. The form of research was carried out by one test on two groups. The test was carried out to measure students' mathematical reasoning abilities after the treatment. The group of students who were given treatment using problem-based learning was the experimental group, while the students who were given treatment using conventional learning were the control group.

The research was conducted at MTs Negeri 3 Mempawah with a population of all eighth-grade students of the 2019/2020 school year, which consisted of five classes. As for sampling using random techniques, in determining the experimental group, the researcher drawn randomly so that the VIII C class was used as an Experiment group consisting of 33 students and VIII A class was used as a control group comprised of 33 students.

The data collection technique used was to measure students' mathematical reasoning abilities after being given the action. The measuring instrument used in the test is in the form of essay questions carried out at the time of the post-test. Test items designed to obtain information on mathematical reasoning abilities were questions that contained indicators of mathematical reasoning. The indicators of mathematical reasoning were as follows: propose an assumption; manipulating mathematics, drawing conclusions, compiling evidence; provide reasons or evidence of the correctness of the solution; checking the validity of the argument; find patterns or properties of mathematical phenomena to make generalizations.

The data analysis technique was carried out in this study using the t-test with the criteria if H_0 is rejected if $t_{count} > t_{table}$ and H_0 is accepted if $t_{count} \leq t_{table}$. Based on these criteria, the following hypothesis is obtained:

H_0 : There is no effect of problem-based learning on students' mathematical reasoning abilities

H_1 : There is an effect of problem-based learning on students' mathematical reasoning abilities

The t-test is carried out after the data is normally distributed using the Lilliefors test and has a non-homogeneous variant using the F test. After calculating the t-test, it is obtained $t_{count} = 11.15$ and $t_{table} = 1.99$ with $\alpha = 0.05$. Because of the value of $t_{count} > t_{table}$, it can be concluded that problem-based learning affects mathematical reasoning abilities.

RESULTS AND DISCUSSIONS

A problem-based learning model improved mathematical reasoning skills in VIII grade students of MTs Negeri 3 Mempawah. These results were obtained from the mathematical reasoning test results, carried out at the post-test after being given action, namely problem-based learning. The details of the students' mathematical reasoning ability tests can be seen in Table 1 below.

Table 1. Description of the Mathematical Reasoning Ability Test Score

Group	The Number of Students	Average Score	Standard Deviation	Minimum Score	Maximum Score
Experimental	33	67,73	6,78	52	82
Control	33	41,58	11,6	24	60

Based on the table above, it can be seen that the minimum score obtained from each group was 52 for the experimental group and 24 for the control group. The maximum score obtained from each group is 82 for the experimental group and 60 for the control group.

The average score obtained by the experimental group was 67.73, while the control group obtained an average score of 41.58. It means that students who are given problem-based learning actions are higher than the average mathematical reasoning ability of students who are given conventional learning.

In addition, the standard deviation of the experimental group is lower than the standard deviation of the control group, namely 6.78 for the experimental group and 11.6 for the control group. It showed that the mathematical reasoning ability of the experimental group is more homogenous than the control group.

The post-test score of mathematical reasoning abilities was used to obtain information on whether there was an influence on problem-based learning on experimental group students. Based on the data analysis results that have been done, the average result was 67.73 for the experimental group and 41.58 for the control group. The average score provided information in the learning process using a problem-based learning model that affected students' mathematical reasoning abilities. It is in line with Rusman's statement (in Maryam: 2016), which stated that to encourage students to gain knowledge and understanding of concepts, increase critical thinking, have independence, and skills to participate in group work and problem-solving abilities, a learning approach is needed that starts from the presentation. Problems in accordance with the material to be studied.

The effect of problem-based learning was evident during the learning process, students worked on the problems given with the teacher individually, and then students continued the discussion. With individual activities, students could work indirectly on the teacher's problems independently and then continued with discussion activities in each group to solve problems.

Group discussion activities help students improve their mathematical reasoning skills to solve problems given by the teacher. Students solved the problems on the problem sheet, worked together and shared knowledge with their respective group members.

Discussion activities could make students more active so that students who have relatively high mathematical abilities will improve their understanding and sharpen their reasoning in solving problems. At the same time, students who have low mathematical abilities can get a better understanding because these students get explanations from their friends. With the occurrence of group discussions, errors in understanding the problems experienced by students can be eliminated.

Furthermore, at the stage of developing and presenting the work, it was also a place for students to discuss. Each group presented the results of their work, and then the other groups were allowed to ask questions if there were students who did not understand. Even if there were students who had different solutions, these students can present their results. Therefore, the learning process applied a problem-based learning model has provided students to influence learning actively.

In contrast to students who get learning using conventional learning models, students were not given the opportunity to interpret themselves to solve math problems in this class. It makes students more likely to memorize formulas to solve math problems. If students forgot to memorize formulas, students will find it difficult to solve math problems. It is very different from the experimental group, which was given learning using a problem-based learning model. Students were required to be more independent in solving problems.

The control group that implemented learning using conventional learning models was generally teacher-centered, so that teachers played a more active role than students. It can trigger the learning atmosphere to become monotonous to result in students becoming bored more easily in following the lesson. As a result, the control group students' mathematical reasoning ability results were lower than the students' mathematical reasoning abilities in the experimental group using the problem-based learning model.

CONCLUSIONS

Based on the results of research conducted in class VIII MTs Negeri 3 Mempawah, the following conclusions can be drawn:

1. The application of problem-based learning models affects students' mathematical reasoning abilities.
2. Students' mathematical reasoning abilities who are given action using problem-based learning models are better than students who are given conventional learning models.

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