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The Effect of Problem-Based Learning Model on Student's Mathematic Connection Ability in Mathematics Learning in SMP N.1 Rantau Utara

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Abstract

The purpose of this study was to determine students' mathematical connection abilities in the application of problem-based learning models and to determine the effect of student learning using problem-based learning models at SMP Negeri 1 Rantau Utara. The research method used is quasi-experimental research, The population in this study were all students of class VIII SMP Negeri 1 Rantau Utara for the Academic Year 2021/2022 as many as 288 people, then from 8 classes, two classes were selected as samples, namely class VIII-2 which consisted of 36 students who were taught by problem-based learning model, class VIII-5 consisted of 36 students who were taught by conventional learning model.The analytical technique used is descriptive analysis to describe student activities, teacher's ability to manage learning, and student response processes. The results of the analysis of the Gain data for the problem-based learning model class with the conventional model class using the t-test obtained the value of tcount= 8,54 from the distribution list t for □ = 0,05, and dk = n1 – n2 – 2 or dk = 70 obtained ttable= 1,959. By comparing between ttable and tcount obtained tcount > ttable then Ha is accepted. Thus, the results of this study can be stated that there is an effect of problem-based learning models on increasing students' mathematical connection abilities.

Keywords
Mathematical; Connection Skills; Problem-Based Learning Models

I. Introduction

Mathematics lessons are one of the auxiliary sciences that are very important and useful in everyday life as well as in supporting the development of science and technology. Mathematics must be able to be a means to improve students' reasoning power and can improve their ability to face the challenges of everyday life. Abdurrahman (2003:118) argues that "the reason for the need to learn mathematics is": (1) clear and logical means of thinking, (2) means of solving problems of daily life, (3) means of recognizing patterns of relationships and generation of experience, (4) means of increasing awareness of cultural development". Mathematics learning presented using Student Worksheets requires active participation from students, because the Student Worksheets are a form of teacher effort to guide students structured through activities that are able to attract students to learn mathematics. In addition, learning with Student Worksheets can make the learning process more effective as expected in each learning that is increasing the creativity of students' thinking so that learning objectives are achieved. (Tarigan, E. et al. 2020)

Suherman (2001:45) argues that "there is no concept or operation in mathematics that is not connected with other concepts or operations in a system, due to the fact that the essence of mathematics is something that is always related to something else". No

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mathematical connection ability, one cannot solve math problems with math itself, mathematics with other disciplines, and math with the real world. Nowadays, many students think that mathematics is difficult to understand, it is possible that the basic knowledge of mathematics is still lacking, including the students' mathematical connection abilities are still relatively low.

Without connections students have to learn and remember many concepts and abilities that are isolated. With connections students can build new understanding on previous knowledge. There are many factors that affect student learning outcomes, one of which is the condition of student learning subjects in the form of physical conditions, intelligence, talent and interest in learning. Another factor that causes the difficulty of students achieving maximum learning outcomes is the lack of appropriate learning models applied in several schools so far. A visible indication that educators are almost the only source of information for students in the teaching and learning process.

Results of observations at SMP Negeri 1 Rantau Utara, the researcher saw that the teacher still taught using the lecture method and the students only passively sat and listened. This results in students not understanding and understanding, as a result students often only memorize formulas and imitate how to work on examples of questions given by the teacher. And when the teacher gives math problems that are different from the example's given students have difficulty solving them. Like the case in working on problems in the form of stories, Although the story questions have often been encountered by students from elementary to junior high school, however, in reality there are still many students who have difficulty solving problems in the story. Another problem that occurs in SMP Negeri 1 Rantau Utara based on the observations of researchers during the learning process is that students tend to be lazy when the teacher gives assignments and exercises.

Based on the description above, it can be understood that the selection of learning models used by teachers of course also affects student learning activities. Professional and creative teachers will only choose teaching models that are more appropriate to stimulate higher order thinking in problem-oriented situations in activating students during the learning process. Professional and creative teachers also make preparations by setting the topic of discussion of the material and learning objectives as well as the types of student learning activities so that learning will go well. With the problem-based learning model, it is expected that students will be more helpful in increasing mathematical connection skills so that students think more creatively.

This model is suitable to be applied to mathematics because this subject requires students to be able to have skills, these skills can be trained step by step. Students themselves to search, process, and conclude on the problems studied, then the knowledge he gets will stick in the mind longer.

Trianto (2010:92) suggested that problem-based learning is an effective model for teaching higher order thinking processes. This learning helps students to process ready-made information in their minds and construct their own knowledge about the social world and its surroundings. This learning is suitable for developing basic and complex knowledge.

Based on this phenomenon the author feels interested in carrying out research, in this case the author summarizes it in a title: The Influence of Problem-Based Learning Models on Students' Mathematical Connection Ability in Learning Mathematics at SMP Negeri 1 Rantau Utara". With the aim of knowing students' mathematical connection abilities in the application of problem-based learning models and to determine the effect of student learning using problem-based learning models at SMP Negeri 1 Rantau Utara.

II. Review of Literature

2.1.Definition of Mathematical Connection

Rusefendi (2009:31) said that mathematics is formed as a result of human thinking related to processes, ideas, and reasoning. Armanto (2001:6) argued that the purpose of learning mathematics should be directed at students' understanding of various facts, procedures, mathematical operations and having the ability to count to solve math problems correctly. By learning mathematics, students are expected to be able to solve problems around them critically, logically and honestly.

Sumarmo (2006:112) argues that mathematical connection is two words derived from mathematical connection, which was popularized by NCTM and used as a standard for elementary and middle school mathematics learning curriculum. To be able to make a connection, you must first understand the problem and to be able to understand the problem you must be able to make connections with related topics.

Suherman (2001:45) argues that there is no concept or operation in mathematics that is not connected with other concepts or operations in a system, due to the fact that the essence of mathematics is something that is always related to something else. Making connections is a way of creating understanding and otherwise understanding something is making connections.

According to Sumarmo (2006:119) There are three objectives of mathematical connection in learning at school as follows:

1. Expanding student knowledge. With a mathematical connection, students are given a material that can reach various aspects of the problem both inside and outside the school, so that the knowledge gained by students does not rely on the material being studied alone.
2. Seeing mathematics as a unified whole, not as a stand-alone material
3. Stating relevance and benefits both at school and outside school. Stating relevance and benefits both at school and outside school. Through mathematical connections, students are taught concepts and problem-solving skills from various relevant fields, both within the field of mathematics itself and with fields outside mathematics.

Based on the explanation above, it can be concluded that the purpose of mathematical connections in schools is to broaden students' knowledge; views mathematics as a unit, not as a stand-alone material and recognizes the relevance and benefits of mathematics, both at school and outside of school.

Next Herdian (2010:111) argues that mathematical connections are divided into three groups of aspects, that is: (1) aspects of connection between math topics, (2) aspects of connection with other disciplines, and (3) connection aspect with students' real world (connection with daily life). Through mathematical connections, it is hoped that students' insight and thinking will be more open, not only focused on the topic being studied, so as to foster a positive attitude towards mathematics.

2.2.Problem Based Learning Model

Sagala (2007: 175) states that a model can be understood as a type or design, a description or analogy that is used to assist the process of visualizing something that cannot be directly observed, a system of assumptions, data, and inferences used to systematically describe an object or event, a simple design of a work system, or a simplified translation of reality.

Arends (2001:24) emphasizes that the learning model is a comprehensive plan or pattern to help students learn types of knowledge, certain attitudes or skills. The learning

model is related to a teaching plan that describes the process taken in the teaching and learning process in order to achieve change.

J.J Rousseau (Masitoh, dkk, 2005: 36) states that "we should not emphasize the amount of knowledge a child is expected to have", but must emphasize what children can learn and what children want to know according to their interests. according to Van De Walle (2008:23) argues that "in constructivism theory rejects the possibility that children are likened to a blank white paper". Of course, children don't just absorb ideas from their teachers, but children are capable creators of their knowledge."

Trianto (2009:61) suggested that problem-based learning is an effective approach for teaching higher order thinking processes. This learning helps students to obtain ready-made information in their minds and construct their own knowledge about the social world and its surroundings.

Table 1. Problem Based Learning Implementation Phase

PHASE	TEACHER ACTIVITIES	STUDENT ACTIVITIES
Phase I	Orient students to the problem. Explain the learning objectives, the logistics needed, motivate students to be actively involved in problem solving activities .	Listen to the teacher's explanation.
Phase II	Organizing students for learning. Helping students to limit and organize learning tasks related to the problem at hand .	Students actively follow and work on learning assignments according to the problems given
Phase III	Guiding individual or group investigations. Encourage students to gather appropriate information, carry out experiments, and search for explanations and solutions.	Students are active in seeking and finding information on solving learning problems.
Phase IV	Develop and present the work. Help students plan and prepare appropriate works such as reports and help students share assignments with their friends .	Students submit the results of the report on the subject matter related to problem solving
Phase V	Analyze and evaluate the problem solving process. Helping students to reflect on the process used during the solving process.	Students reflect on the results of problem solving on the material being studied

III. Research Method

This research is quasi-experimental research (quasi-experimental), implemented in class VIII SMP Negeri 1 Rantau Utara School year 2021/2022. The population in this study is whole class VIII SMP Negeri 1 Rantau Utara School year 2021/2022 as much 288 people. Sampling was carried out using a random group sampling technique (cluster random sampling) that is selected class VIII-2 which amounts to 36 students taught with a problem-based learning model class VIII-5 totaling 36 students who were taught using conventional learning mod. This study uses two types of instruments, namely the connection ability test in mathematics and the observation sheet.

IV. Result and Discussion

4.1 Description of Research Results

The implementation of this research is for Class VIII students of SMP Negeri 1 Rantau Utara Academic Year 2021/2022. The object of research is the low learning outcomes of students' mathematics related to the teacher's ability to carry out learning. The low student learning outcomes are certainly related to teacher competence, especially with work experience as a teacher and level of education, the teacher should have the ability to implement learning that can improve student learning outcomes.

4.2 Pre-Test Results of PBL and Conventional Class Students

Before carrying out learning, a pre-test is first carried out which is tested to determine the initial abilities of students without carrying out learning. Students following initial proficiency for problem-based learning classes and conventional classes 36 people each. The average results of the pre-test scores in the problem-based learning class is 45,14, and the results of the average value of the pre-test in conventional class is 44,58.

4.3 Post-Test Results of PBL and Conventional Classes

After the pre-test was carried out in both classes and there was no difference in the students' initial abilities, then the two classes were given treatment namely for the experimental class given problem-based learning while the control class is given conventional learning. After each class received treatment then each class at the end of the lesson is given a post-test to find out the improvement of students' mathematical connection skills. From the post-test results, the average post-test score with problem-based learning is 80,00 and post-test-average with conventional learning is 65,00.

4.4 Research Data Analysis

The research instrument in the form of a student's mathematical connection ability test was used to find out students' mathematical connection abilities after studying Material Presentation of Data in each class either class that uses problem-based learning model learning as well as conventional classes. Before being used in research activities, this instrument was validated to students who were not the research sample.

4.5 Research Analysis

The research instrument in the form of a student's mathematical connection ability test was used to determine the students' mathematical connection ability after studying the data presentation material in each class, both classes using problem-based learning models and conventional classes. Before being used in research activities, this instrument was validated to students who were not the research sample.

The results of the calculation of the One-Sample Kolmogorov-Smirnov Test obtained Z values of 1.132 and 0.910, with asymptotic values of each significance of 0,154 and 0,379 for the problem-based learning model class and the conventional model class respectively. The asymptotic value is greater than the significance level 0,05, it can be concluded that the pre-test data for the problem-based learning model class and the conventional model class are normally distributed.

The calculation results *One-Sample Kolmogorov-Smirnov Test* Z value Kolmogorov Smirnov as big as 0,894 and 1,267 with asymptotic values of each significance of 0,401 and 0,081 for model class ar PBI and Conventional model classes respectively. This asymptotic value is greater than the significance level 0,05, it can be concluded that the post-test data for the problem-based learning model class and the conventional model class are normally distributed.

4.6 Homogeneity Test

Count results *Test of Homogeneity of Variances* for the pretest data that is equal to 0,225 > 0,05, it can be concluded that Ho is accepted or in other words the two populations are homogeneous. Count results *Test of Homogeneity of Variances* for post-test result data that is equal to 0,351 > 0,05, it can be concluded that Ho is accepted or in other words the two populations are homogeneous.

4.7 Hypothesis testing

The results of the analysis of the data gain of the problem-based learning model class with the conventional model class using t test, as in the attachment obtained the price t_{count} = 8,54 from the distribution list t for α = 0,05, and dk = $n_1 – n_2 – 2$ or dk = 70 obtained t_{table} = 1,959. By comparing between t_{count} and t_{table} obtained $t_{count} > t_{table}$ then Ha is accepted. Thus, it can be concluded that mathematical connection skills taught by problem-based learning model learning better than conventional learning models.

4.8 Teacher and Student Activities in the Learning Process

In this study, the activities of teachers and students were obtained through observations made by observers when the learning activities of problem-based learning models and conventional learning model is carried out. The results of observations of teacher activities using problem-based learning models in the experimental class obtained an average of 85.00% and for student activities taught by conventional learning models obtained an average of 70.50%. While the results of observing teacher activities with problem-based learning models obtained an average of 80.50% and the average for student activities taught using conventional learning models is 80.00%.

4.9 Discussion of Research Results

Overall, it can be seen that the average mathematical connection ability of students who are taught using problem-based learning models is higher when compared with conventional models. Students' mathematical connection ability in conventional learning models still far from expected. Calculation results on t-test based on students' mathematical

connection abilities obtained t_{count} = 8,54 and t_{table} = 1,959 at the level of significance α = 0,05 with dk = 70. The data shows the ability of students' mathematical connection with the problem-based learning model better than conventional learning models.

Based on the opinion above, it can be said that problem-based learning is learning that can challenge students to learn to learn, work together in groups to find solutions to real problems this problem is used to remind curiosity and critical thinking skills and analysis and to find and use appropriate learning resources in solving problems.

V. Conclusion

Based on the results of research and data analysis using the average difference test or t test it can be concluded that the results of the analysis of the problem-based learning model class gain data with the conventional model class by using t test obtained the price t_{count} = 8,54 from the distribution list t for α = 0,05, and dk = $n_1 - n_2 - 2$ or dk = 70 obtained t_{table} = 1,959. By comparing between t_{table} and t_{count} d obtained $t_{count} > t_{table}$ then Ha is accepted.

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