ME – 11

The Effect of Problem Based Learning to Mathematical Reasoning Abilities of High School Students

Topic: Series and Sequence

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Abstract— Knowing the information from the reality on the school that the mathematical reasoning students in class X is still less. Motivation and activity of students in the learning of mathematics is also less. Based on this background the purpose of this study is to determine whether there is influence the activity of students using problem-based learning in the ability of the mathematical reasoning students, whether in mathematics using problem-based learning can achieve the criteria completeness minimum (CCM), and to investigate the activities of teachers and students during the learning takes place. The method used in this research is the experimental method. In doing in class X SMA Negeri 1 Jalaksana Brass in the academic year 2013/2014. Selection of the samples in this study conducted with a purposive sample technique to make the class X-3 as the experimental class using problem-based learning and class X-2 as the control class by using conventional learning with expository. The instrument used for data collection in this study is an essay test in accordance with the indicators of mathematical reasoning to the material Exponent, The Roots and logarithm. Tests are given consists of 7 questions of reasoning. The results showed a positive effect of the activity between the use of problem-based learning to students' mathematical reasoning abilities. This is evidenced by the size of the acquisition value over the average posttest experimental class than the control class. Knowing the positive value of the coefficient update equation linear regression model that explains the meaning of the positive value of the activity of students in problem-based learning process a positive influence on students' mathematical reasoning abilities. The achievement of CCM using problem-based learning.

Keywords: *influence, problem based learning, mathematical reasoning.*

I. INTRODUCTION

In the era of global information, people are required to have the ability to acquire, select, manage and act on that information to be used in a dynamic life and full of challenges and competition. A dynamic life demands that we have a critical ability, this ability can be developed through learning mathematics.

Mathematics in schools (Depdiknas, 2006) are (1) train the way of thinking and reasoning to drawing conclusions. (2) develop a creative activity that involve imagination, intuition, and discovery by developing divergent thinking, original, curiosity, make prediction and expectation, as well as trial and error. (3) develop the ability to convey information and communicate ideas. The explanation can be said that there is a close relationship between the formation of human character which is expected by the learning of mathematics, so that the learning of mathematics must be given to all students without exception to be trained to think logical, analytical, systematic, and creative.

Learning mathematics based Education Unit Level Curriculum current is intended that learners have the capability of understanding the concepts, reasoning, problem solving, and mathematical

communication. By not ignoring other skills, reasoning ability plays an important role in the learning of mathematics. The ability to reason is not only required students as they learn mathematics and other subjects, but also is needed for every human being at time when its own decisions. Reasoning ability is also necessary in order to achieve better results in solving a mathematical problem. Therefore, we need to realize that the reasoning skills should be ~~is~~ grown within the individual student.

Based on discussions with the author of a mathematics teacher in class X SMA Negeri 1 Jalaksana Brass obtainable information that mathematics learning activities include students have difficulty to solve problems that require analytical reasoning. A number of students who have understood the theoretical mathematical topic was experiencing difficulty when questions or problems presented in the form of analyze. Reality on the ground students simply memorize concepts and less able to use these concepts when they have a problem in real life. According to the survey, several high schools in West Java Kuningan area, generally the teacher explains concept be informative, giving the example problems, and provide exercises. The tradition of teaching such as this is a common characteristic for teachers implement mathematics in Indonesia and could be said that conventional mathematics.

Problem-based learning model is expected to be a solution or alternative in this research for teachers in order to improve students' mathematical reasoning abilities. Based on the above, the authors are interested in conducting research on "The Effects of Problem Based Learning Mathematical Reasoning Ability Of High School Students (Research Experiments in Class X SMAN 1 Jalaksana Brass)."

II. RESEARCH METHOD

This study used a study design shaped pretest-posttest control group design. In accordance with the study design used, this research involves two classes of experimental class and control class. To saw the effect of problem-based learning to students' mathematical reasoning abilities pretest and posttest in both classes. The design used appropriate (Sugiono, 2012: 116) could be described as follows.

R O1 X O2

R O3 O4

Information:

R: The sample study were randomized (random)

O1: pretest experimental class

O2: posttest experimental class

O3: Pretest control class

O4: posttest control group

X: Treatment of experimental class

The study population consisted of ten classes with all students numbered 400 students. Based on information from the school, students SMA Negeri 1 Jalaksana Brass had diverse capabilities. The sampling technique in this study used purposive sampling techniques. Based on the opinion of Sudjana (Sudjana, 2005: 168) "The definition of a purposive sample (sample purposive) that sampling based on individual considerations or consideration of researchers." Since the measurement is a measurement of high-level analyze so that researchers would use the excellent class. So that became a purposive sample in this research is class X-3 were used as experimental class learning used problem-based learning with the consideration that the class had an average UN high mathematics, so that assumed to have good reasoning ability. Data analysis was performed in order to draw conclusions with regard to the problem to be solved in the research. The data obtained data about students' mathematical reasoning abilities

Here are the steps performed in the data analysis.

1. Calculate descriptive statistics of mathematical reasoning ability by pretest and posttest, and calculates a score initial reasoning skills and reasoning abilities final score in each class were selected as sample.
2. To determine the increase in students' mathematical reasoning abilities after learning test was used Gain normalized.

3. Perform data normality test pretest, posttest and Gain normalized.
4. To test the homogeneity of data pretest, posttest, and Gain normalized.
5. To test the difference between two average.
6. Scaterplots observations on the value of the activity with the value posttest in the experimental class.
7. Perform simple linear regression test.
8. observations on scaterplots residue obtained from the simple linear regression model.
9. Perform calculations mastery learning outcomes could be seen from the posttest that have reached KKM.

III. FINDING AND DISCUSSION

After collecting the data, the data obtained in the form of initial test scores and final test scores, which average could be seen in Table 1.

Table 1

Descriptive Statistics Data Results pretest and posttest

Statistical Data	Experiments		Control	
	Pretest	***Posttest***	***Pretest***	***Posttest***
Number of Students	40	40	40	40
Largest Data	24	94	24	92
Data Smallest	00	10	00	00
Range	24	84	8,08	27,06
Average	11,72	65,97	11,22	56,07
Standard Deviation	6,88	25,47	8,08	27,06
Variance	47,43	649,20	65,410	732,533

Knowing the information from the test results influence (simple linear regression) showed that there is a linear relationship between student learning activities using problem-based learning with mathematical reasoning abilities of students in the experimental class. R-square values obtained or R2 = 0.817 = 81.7%. These values indicate the size of the goodness of fit between the regression model or data obtained from a class that implements problem-based learning. The R2 also shows the diversity of data able to be explained by the regression model $Y = \alpha + \beta x$. In addition there is a 28.3% variable diversity of data that is not explained by other variables in addition to the attitude shown in the process of problem-based learning.

Information obtained from the equation regression model received is Y = -170 + 2,962x. The linear regression model equation could be known the acquisition value of a positive coefficient of 2.962. This shows that the influence of the activity of students in problem-based learning activities had a positive influence on students' mathematical reasoning abilities. This means more active in the learning process, the higher the students' mathematical reasoning abilities.

From the acquisition of information regrsi linear model equations are received and information value of R2, it could be seen that there are positive influence between problem-based learning with students' mathematical reasoning abilities.

Teacher activity observation results are presented in Figure 1 as follows.

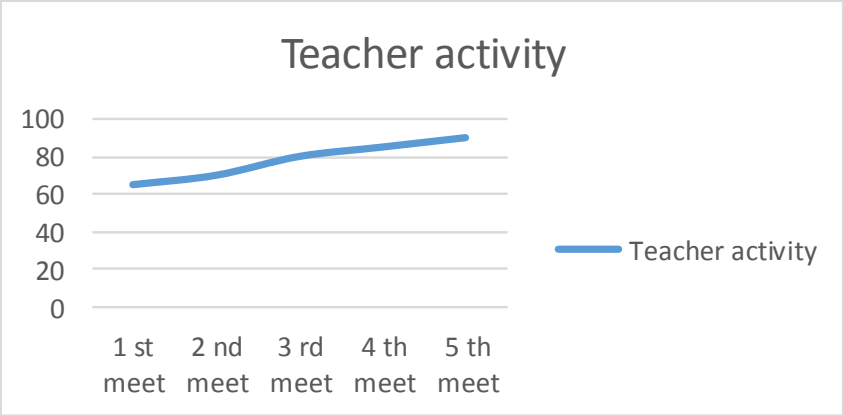

Figure 1 Teacher activity observation results

Knowing the information from Figure 1 and data analysis observation result, the value of teacher activity from the initial meeting until the end of the meeting has increased dikatagorilan good.

Then, from the results of observations on the implementation of problem-based learning at the first meeting until the fifth meeting, the information obtained at the first meeting activity value of teachers is 35 and the percentage is 70%, the second day of the value of the activity of teachers is 39 and the percentage is 78%, whereas the third day activity value of teachers namely 42 and the percentage is 84%. On the fourth day activity value and the percentage of teachers that is 45 to 90%. On the last day that the fifth meeting of the value of the activity of teachers is 47 and the percentage is 94%.

At the initial meeting measures problem-based learning activities that have been going on for quite match the characteristics of problem based learning has been established, but this has not been maximized. However, to further the implementation of learning activities, measures problem-based learning has been more leverage, as seen in the increase in the percentage of activity the teachers obtained.

Student activity observation results are presented in Figure 2 as follows.

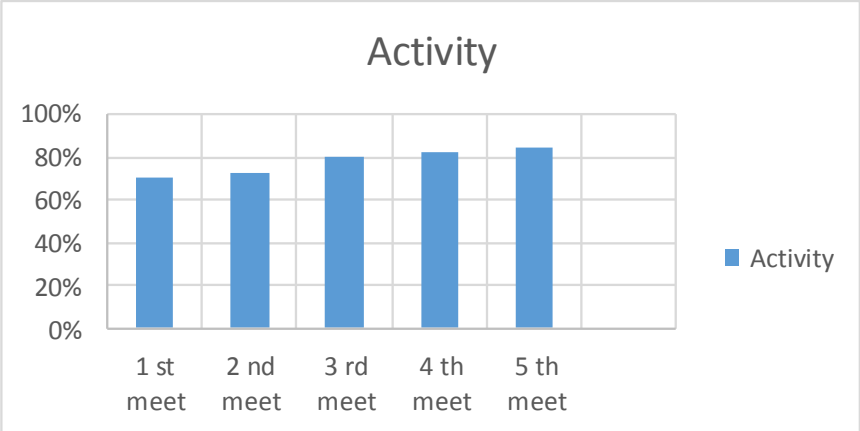

Figure 2 Observations on implementation

Knowing the information from Figure 2 that the results of observations on the implementation of problem-based learning carried out in the experimental class obtained average value activity at its meeting also increasing, with the first meeting obtained a value of 2.81 or 70% were terkatagori good. The second meeting enhancement experienced by 4% of obtaining a value of 2.96 or 74% were

good category. The same thing also at the third meeting, namely an increase of 6% from the first meeting, the acquisition value at the third meeting soon is 3.2 or 80% were good category.

Acquisition value at the fourth meeting an increase of 2% from the third meeting, namely 3.33, or 83% were categorized either. At the fifth meeting or end the meeting there was an increase from the fourth meeting of 2%, is to obtain a value of 3.41 or 85% were categorized either. Of all the activities in every meeting obtained by the average value of the activity of 3.15 or 76%, which means the problem-based learning activities held in the experimental class good category.

IV. CONCLUSION AND RECOMMENDATION

A. *Conclusion*

1. Based on information from the analysis of research data shows that the mathematical reasoning abilities of students in the experimental class in mathematics learning problem-based learning used higher when compared with the control classes in mathematics menggunakkan conventional learning is expository. This can be demonstrated by the increase in the average scores of 54.23 to 44.85 for the experimental class and control class, so there is a difference between experimental class control class is 9.38. Aside from the average value of the test, students' mathematical reasoning ability difference between the experimental class and control class can also be seen from the average score of N-Gain. For the experimental class average score of N-Gain is 0.62 while the control class 0.51.Then, based on test results influence (simple linear regression) between the activity of students with mathematical reasoning skills gained sig. 0,000 = 0%. Significance level $\alpha = 0.05 = 5\%$. Because Sig.0,00 <0.05 hence H0 is rejected or, in other words H1 accepted. This suggests the hypothesis proposed by the author proved, that there is the influence of problem-based learning to students' mathematical reasoning abilities on subab "Exponent, The Roots and Logarithms" in class X-3 SMA Negeri 1 Jalaksana Brass. Then the R-square values obtained or R2 = 0.817 = 81.70%. These values indicate that the problem-based learning affects students' mathematical reasoning abilities on the subject of "Exponent, The Roots and Logarithms" As much as 81.70%.
2. Based on the analyze of observational data activity of teachers and students in the implementation of problem-based learning that is applied to the experimental class turns out there is increased activity of teachers and students from the first meeting until the fifth meeting. The average value in every meeting the teacher activity reached 83.2% with good criteria and the average value in every meeting of student activity is 78% with good criterion. At the first meeting of teachers and students are still not used in carrying out the problem-based learning. But at the next meeting of teachers and students have started to understand how the problem-based learning is applied. There is an increased capability of information obtained KKM, when the pretest none of the students who reached the KKM, increased during the posttest students who achieve KKM as many as 24 students. This is because each of their meetings learning, researchers gave exercises in the form of worksheets that settlement of the matter menggarahkan on the characteristics of problem-based learning, as this is routinely done at each meeting so that the students get used to solve problems with the steps of problem-based learning. So as to solve the problems students can do so easily and can increase the yield of each holding of the test. It can be concluded that by using values-based learning can be achieved KKM.

B. *Recommendation*

Researchers only apply problem-based learning in class X SMA Negeri 1 Jalaksana Brass and limited to the subject of "Exponent, The Roots and Logarithms", to the researchers expect the results of this study as consideration for teachers and prospective teachers, so that research can be continued research on the subject of different topics.To foster reasoning abilities in mathematics, especially material related to non-routine matters, teachers are advised to use a problem-based learning to encourage students to be more active to build knowledge and develop mathematical reasoning skills.

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