THE EFFECTIVENESS OF LEARNING MODELS REALISTIC MATHEMATICS EDUCATION AND PROBLEM BASED LEARNING TOWARD MATHEMATICAL REASONING SKILLS AT STUDENTS OF JUNIOR HIGH SCHOOL

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Abstract

This research aims to analyze the difference effectiveness of learning model Realistic Mathematics Education (RME) and model learning problem based learning (PBL) to students' mathematical reasoning skills. The design of this research is quasi experiment with pretest-posttest control group design. The population of this study is the students of grade VIII SMPN 1 Watubangga 2015/2016 year that studying about building a flat side space. The data of mathematical reasoning skills is obtained by using the instrument in the form of mathematical reasoning test. Data analysis technique used is descriptive statistical analysis, F test with t test (paired-samples t test and independent-samples t test), at $\alpha = 0,05$. Based on the result of analysis of research data obtained that: 1). Student's mathematical reasoning skills before being taught with RME, PBL, and Direct learning models are in the less category after being given learning with the learning model RME, PBL and Direct students' mathematical reasoning skills are in sufficient category. Increased students' mathematical reasoning skills are in the medium category; 2). There is an improvement in students' mathematical reasoning skills after being taught with RME, PBL and Direct learning models; 3). The mathematical reasoning skills of students taught using the RME learning model were not significantly different from those taught by the PBL learning model; 4). There is a difference in the effectiveness of the learning model on improving students' mathematical reasoning skills, which is taught using a learning model RME more effective than students taught by direct learning model; 5). The students' mathematical reasoning skills are taught using the PBL learning model more effective than students taught by direct learning model; 6). Student activity during learning process using RME learning model and PBL learning models, indicating that students are very active.

Keyword: Mathematical reasoning skills, Realistic Mathematics Education, Problem Based learning, Direct learning.

A. Introduction

One of the subjects that support the development of science and technology is mathematics. Mathematics occupies an important role in the field of education. Mathematics as a science has a very important role in life. Math is taught because it can develop the ability to reason, namely systematic thinking, logical, and critical in communicating ideas or ideas to solve the problem (Djamarah & Aswan, 2005). For that Learning is a process that not only absorbs information from the teacher, but also involves various activities or actions that must be done primarily, if want better learning outcomes.

Based on preliminary interviews that has been done by researcher with teacher math of VIII grade and students daily test results obtained information, those are, in particular students' mathematical abilities eighth grade students of SMP Negeri 1 Watubangga, still low with an average of 62.51 completeness value of at least 70. It can be seen from the results of daily test questions in the form of students essay on the material S PLDV shows that they are generally less able to solve problems in aspects of reasoning that is, less ability 1) present a statement in the form of pictures or diagrams, 2) perform mathematical manipulations 3) compile evidence, give reasons 4) drew the conclusion from the statement. In problem solving steps.

Based on the interview and see students' task in completing the test questions given by the teacher, it can be deduced that, students of class VII I SMP Negeri 1 Watubangga still weak in expressing and explaining a concept or idea of using oral, symbol, emblem, or mathematical notation. Students are less able to explain the ideas in the form of text and images, are less able to give explanation and verification of finishing answers and difficult to draw conclusions, and students are less able to put forward its ideas to the word - the word itself, students are not familiar with the issues using reasoning languages, such as presenting statements in the form of drawings or diagrams, performing mathematical manipulations, compiling evidence, giving reasons, drawing conclusions from statements and students less able to express their opinions within learning . Habituation of learning like this results in weak student ability in reasoning.

Realistic Mathematics Education (RME) learning model is one of alternative learning that requires students to construct knowledge with their own ability through their activities in learning activities. The main idea of learning by using the RME learning model is that students should be given the opportunity to reinvent mathematical concepts with adult guidance (Gravemeijer, 1994). The principle of rediscovery means that students are given the opportunity to discover their own mathematical concepts by completing the various contextual questions given at the beginning of the lesson. Based on the problem, students build a model based on the situation then finish up to gain formal mathematical knowledge.

Problem Based Learning (PBL) is an effective approach for teaching high-minded thinking processes; this learning helps students to process ready-made information in their minds and develop their own knowledge of the social world and its surroundings

Barrows (1980), as PBL experts stated that the definition of PBL is a teaching method that is based on the principle that the issue (problem) can be used as a starting point to acquire or integrate knowledge new. PBL is a learning method that uses problems as a first step in collecting and integrating new knowledge (Suradijono, 2004).

B. Literature Review
Realistic Mathematics Education (RME) Learning Model

The real world in RME used as a starting point for the development of ideas and mathematical concepts. De Lange (1995: 7) defines the real world as a concrete real world, presented to students through mathematical applications. That's how we understand the process of learning mathematics that occurs in students, which occurs in real situations.

The process of developing the concepts and ideas of mathematics started from the real world by De Lange as an endless circle called conceptual mathematical and has a schematic model of the learning process as in the following figure:
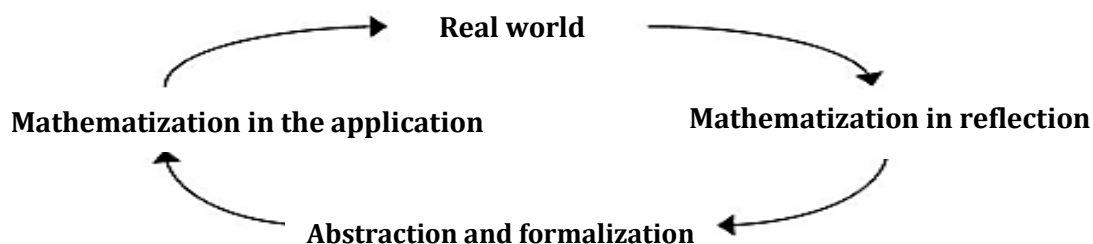

Figure 1. A schematic of RME learning process model

A schematic model for the learning process is described as an endless cycle, the process more important than the result

Learning Model of Problem Based Learning (PBL)

Problem Based Learning (PBL) is an effective approach to the teaching of high-order thinking processes, this learning helps students to process the ready-made information in their minds and develop their own knowledge of the social world and its surroundings.

Problem Based Learning (PBL) is a problem-based teaching methods are characterized by their real problems as a context for the students to learn critical thinking and problem-solving skills, and acquire knowledge (Duch, 1995). Problem Based Learning (PBL) is a learning method that encourages students to learn how to learn and work together in groups to seek solutions to real-world problems. Problem simulation is used to activate students' curiosity before starting to study a subject.

PBL is a learning process that is the starting point of learning based on real life problems and from this problem students are stimulated to learn the problems based on knowledge and experience that they have previously (prior knowledge) so that from this prior knowledge will form new knowledge and experience.

Direct Learning Model

Model of direct learning or direct instruction, also known as expository learning strategy and whole class teaching. Direct learning is a learning model that consists of teacher explanation of new concepts or skills to students.

One of the characteristics of a learning model is the syntax / learning stage. In addition to paying attention to the syntax, teachers who use direct instruction must also pay attention to other environmental variables, namely academic focus, direction and teacher control, high expectations for student progress, timing and impact of learning. Joyce and Weil (2011) states some of the most important advantages of direct learning is the academic focus is the priority of the selection of tasks that students must do during the learning, academic activities should be emphasized.

Ability of Mathematical Reasoning

Reasoning is the ability to think. NCTM (2000) affirm think and proves is one of the five competencies that must grow and develop when children learn mathematics.

Sumarmo in Fahinu (2007: 4) suggests that the ability of mathematical reasoning is an emerging ability in the form of: 1) drawing conclusions, 2) composing and testing conjecture, 3) formulating the opposite of the example, and 4) constructing arguments.

The importance of reasoning ability in learning mathematics is also put forward by Suryadi in Saragih (2007: 4) which states that, learning that emphasizes the activities of reasoning and problem solving is closely related to the achievement of high student achievement.

The reasoning indicator used in this research is, 1) presents statements in the form of drawings or diagrams; 2) perform mathematical manipulation ; 3) compile evidence, give reasons; 4) draw conclusions from the statement.

C. Methodology

This research is intended to know the improvement of students' mathematical reasoning skills through Realistic Mathematic Education (RME) model and problem based learning (PBL) model. This research is a quasi experimental research with pretest-posttest control design. In this quasi-experimental designs are not grouped randomly but follow grading preconceived.

The design used in this research is Pretest-Posttest Control Group Design The type of data in this study is quantitative data obtained from the results of the students' mathematical reasoning tests. In this study the data collection is done through test and non test. The test was given to measure the ability of mathematical reasoning and observation sheets to see student activity during the learning process with the three learning models. The research instrument is a set of reasoning skills test in the form of written test questions in the form of essay.

Descriptive statistics are used to describe the values obtained by each class in terms of average, maximum value, minimum value and standard deviation. Inferential analysis in this research is used to test the research hypothesis, but first through the other test stages, namely normality test and homogeneity test as a prerequisite test to perform hypothesis testing.

D. Finding and Discussion

1. Findings

Data obtained and analyzed in this research in the form of scores of students' mathematical reasoning test results of observations of students and questionnaire student activity to RME learning , PBL and direct learning. This study involves three different groups of students, so the statistical analysis used is the average difference test of N-Gain mathematical reasoning skills, performed by independent average test difference t sample t-test. Prior to the analysis, first tested the normality and homogeneity test of the population variance. To test the normality of data distribution used Kolmogorov-Smirnov test, and homogeneity test of population variance using Levene test Data analysis of mathematical reasoning skills.

Analysis Descriptive Data Ability Reasoning Mathematical

The data of mathematical reasoning skills is obtained through the test of mathematical reasoning skills. Test the ability of mathematical reasoning given to the experimental group 1 taught by RME, the experimental group 2 taught by PBL, as well as the control class, each performed twice, before giving treatment (pretest) and after treatment (posttest). In the posttest score, in this case the value of students' mathematical reasoning skills after obtaining the learning lesson RME, PBL and direct learning shows the average of students' mathematical reasoning skills. This is intended to see a general overview of students' mathematical reasoning skills after obtaining RME lessons, both PBL learning and direct learning.

The students' mathematical reasoning skills that were taught by RME learning model on Building Space of Flat Side Space have values ranging from 40 as the lowest value up to 90 as the highest value.

The students' mathematical reasoning skills taught the PBL learning model on the flat-side building material, has values ranging from 40 as the lowest to 80 as the highest value. Students who have a good mastery level of 4 people or 20%, students who have a mastery level is 16 people or 80%, and students who have less mastery level does not exist.

The students' mathematical reasoning skills taught by the learning model directly on the matter of building the flat side space and pyramid has a value ranging from 20 as the lowest value up to 75 as the highest value. Students who have a good mastery level of 2 people or 8,70%, students who have a mastery of less than 12 people or 52,17%, and students who have a low mastery level of 9 people or 39,13%. Pre-test and posttest data are described based on mean, standard deviation, maximum value and minimum value in classes taught by RME, PBL or Direct. it was found that in the experimental class 1 or the class taught by RME the average value of pretest was 13,33 with the standard deviation of 11,76, meanwhile the posttest mean value equal to 62,38 with standard deviation 14,71. In the experimental class 2 or the grade taught by PBL the average value of the pretest is 21 with the standard deviation of 11,65, while the posttest average is 58 with the standard deviation of 12,81. In control class or class that is taught by direct learning the average value of pretest is 16,96 with standard deviation 12,41, meanwhile posttest average value equal to 45,65 with standard deviation 17,73.

From pretest and posttest score, then we calculate the normalized gain (N-Gain) of mathematical reasoning skills both in experiment class 1, in experiment 2 class and control class. The average (mean) normalized gain obtained from this calculation is the portrait of an increase in reasoning abilities of students learning to use PBL with RME, learning using PBL learning and direct instruction.

The average ratio of N-Gain and the standard deviation of the mathematical reasoning skills between the group taught by RME, the average N-Gain of the mathematical reasoning skills of the experimental group 2 or the students whose learning using RME is 0,57 higher than the experimental group 1 or students whose learning using PBL is 0,46 and the control group or students whose direct learning is 0,37. This indicates that the improvement of students' mathematical reasoning skills in experimental group 1 when compared with the increase of mathematical reasoning skills in experiment 2 and control group. In general, the quality of improved mathematical reasoning skills in the experimental class 1 and in the experimental class 2 and the control group were included in the moderate category. This can be seen from the average value of N-Gain in succession of 0,46 and 0,57 and 0,36 which lies at intervals of 0,3 and 0,7.

Inference Data Analysis Mathematical reasoning skills

a. Data Analysis Improving Mathematical reasoning skills

The inferential analysis is initiated with some prerequisite tests for pretest, posttest, and normalized gain data such as normality test and homogeneity test of variance. Normality test is performed to find out whether the data is normal or not distributed while the homogeneity test of variance is done to determine the homogeneity of the variance of the population.

The data normality test is performed on the data of reasoning ability in experiment class 1, experiment 2 classes and control group. The test was performed by Kolmogorov-Smirnov test.

The data homogeneity test was performed on the data of reasoning ability on experimental class 1, experiment 2 classes and control class. The test aims to determine the homogeneity of data variance. Based on the results of the test output homogeneity of variance using Levene test in Table 4.9, the value of significance is 0.312. Because the significance value is greater than $\alpha=0.05$, it can be concluded that N-Gain data of mathematical reasoning skills in experiment group 1 and experiment 2 group have the same data variance , or both homogeneous data

b. Hypothesis Testing the Difference of Influence of Learning Model to Improving Mathematical reasoning skills

The test of difference of influence of applying of learning model to improvement of mathematical reasoning skills is done by utilizing N-Gain data (normalized gain) from experiment group 1 and experiment 2 groups and control group. From the N-Gain data group, three hypotheses related to mathematical reasoning were tested.

Hypothesis testing about the difference of influence of applying of learning model to improvement of mathematical reasoning skills for experiment group 1 (RME), experimental group 2 (PBL), and control group (direct learning) through ANOVA F test 1 pathway, to find out whether there is a significant difference in the influence of the application of learning models to improving students' mathematical reasoning skills. It can be seen that the value of F is 8,374 and Sig. (2-tailed) of 0,001. The value is smaller than $\alpha = 0,05$, so the null hypothesis is rejected.

Hypothesis testing about the difference in improving mathematical reasoning skills for experimental group 1 (RME) and experiment group 2 (PBL) t test is done through multiple Comparison. This t-statistical analysis aims to determine whether there is a significant difference between improving mathematical reasoning skills in experimental class 1 students and improving mathematical reasoning skills in experimental class 2 students. The analysis result obtained Sig. value (2-tailed) 0,058. The value is greater than $\alpha = 0,05$, s e so the null hypothesis is accepted.

Hypothesis testing on differences in the increase of reasoning skills for experimental group 1 (RME) and control group were t tested through multiple Comparison. This t-statistical analysis aims to determine whether there is a significant difference between improving mathematical reasoning skills in experimental class 1 students and improving mathematical reasoning skills in control class students. The analysis result obtained Sig value. (2-tailed) by 0,000. The value is smaller than $\alpha = 0,05$, so the null hypothesis is rejected.

Hypothesis testing about the improvement of mathematical reasoning skills for the experimental group 2 (PBL) and control group were t tested. This t-statistical analysis aims to determine whether there is a significant difference between improving mathematical reasoning skills in experimental class 2 students and improving mathematical reasoning skills in control class students. It is seen that the value of Sig. (2-tailed) of 0,043. The value is smaller than $\alpha = 0,05$, so the null hypothesis is rejected.

Data Analysis Student Activities Learning toward implementation of RME and PBL Learning

From the data analysis, it is known that the general plan of RME students consisting of 20 people, the students have done what should be in a learning process, that is responding to teacher questions, activities in group discussion and class discussion, and reduce the behavior that is less relevant to the activity learning. From the observation of student activity during eight times meeting obtained the average activity of student reach 84%. The results indicate that students are in very active category in the RME learning process. From the observation of student activity during eight times meeting obtained the average of student activity reaches 83%. The results indicate that the students are in very active category in the learning process with PBL.

2. Discussion

The result of good data analysis from descriptive analysis shows that the average of RME learning is higher than PBL learning or direct learning. But after comparing the increase in each class through statistical tests, there is a significant difference in the increase in mathematical reasoning skills between the groups of students taught by RME learning with groups of students taught by PBL. These findings strengthen and complement the results of the ultimate research on the RME model. The results of this research is conducted by Kadir (2005) that through the application of Realistic Mathematics learning model (PMR), mathematics learning result of grade V of SD Negeri 3 Poasia Kendari can be improved. From the results of his research also reflected an increase in student learning motivation after students were taught using the RME approach. The results of research conducted by Munarsih (2008) concluded that mathematics learning applying realistic mathematic education (RME) approach can improve students' motivation and learning achievement as an effort to improve understanding of relationship and function concept. In the results of his research, there is an increase in learning motivation and student learning outcomes after using the RME approach.

This is seen in the mean N-Gain scores of both groups which concluded that the average N-Gain mathematical reasoning skills of the student group taught by RME is higher than there is a significant difference in the increase in mathematical reasoning skills amongst the group of students taught with RME learning with groups of students taught by direct learning. This is seen in the mean N-Gain scores of the two groups which concluded that the mean N-Gain mathematical reasoning skills of the student group taught by RME is higher than the average N-Gain score of the student group taught by direct learning. The RME learning one focuses on students' high-order thinking skills. High-level thinking process with intermediaries of contextual issues packaged in student worksheets (LKS). Context developed in accordance with the contextual characteristics that contain problems in everyday life. Then from the beginning the context is designed as an informal mathematics (off model), it is expected that students can develop or apply formal form of mathematics (model for). This math modeling process to develop a students' mathematical reasoning skills.

Student activity in RME learning takes place optimally starting from group activities to solve contextual problems that have been presented on LKS, as well as in-class activities to interact with other groups through class discussions. In general, in this learning the students are educated to form their own knowledge through a series of problem solves formulated on the LKS. Based on the observations made by the observer and the results of the researcher himself (as a teacher), at the beginning of the meeting the students seemed confused by the learning that started with the RME learning as different from the usual . At the time of group discussion only certain groups are active, so also during class discussions only certain students are actively asking and answering, most students have not dared to express their opinions and give suggestions. RME learning is relatively similar in improving students' mathematical reasoning skills. This is supported by student activity in the learning process in the RME and PBL classes. Observed during the experiment showed that the percentage of students each learning activity is likely to increase, until the end of the meeting on RME class and PBL students have some activity related to mathematical reasoning skills students respectively reach 97% and 92%, or in a very active category. At the first meeting, student activity in the learning process is still very awkward with the learning model of RME and PBL. This is because the learning approach used is new for the students. It also looks at the percentage of active students in the class RME and PBL respectively only 71% and 64%, or in the active category. But at the second and third meeting the percentage of liveliness began to increase. This is because the students are getting used to and adjusting to the learning used. Students have begun to be active in asking questions and enthusiastic about the presentation of their work. At the last meeting of the eighth meeting.

E. Conclusion

1. The ability of students' mathematical reasoning before being taught by RME learning are in the category of less, after being given RME study students' mathematical reasoning skills are in sufficient category. Increased students' mathematical reasoning skills are in the medium category.
2. The ability of students' mathematical reasoning before being taught by PBL learning is in the category of less, after given learning PBL students' mathematical reasoning skills is in enough category. Increased students' mathematical reasoning skills are in the medium category.
3. The ability of students' mathematical reasoning before being taught by direct learning are in the category of less, after being given direct learning, students' mathematical reasoning

skills is in enough category. Increased students' mathematical reasoning skills are in the medium category.

4. There is an improvement in students' mathematical reasoning skills after being taught by the RME learning model.
5. There is a significant improvement in students' mathematical reasoning skills after being taught using the PBL learning model.
6. There is a significant increase in students' mathematical reasoning skills after being taught with direct learning models.
7. There are differences in the effectiveness of learning models that are significant to improving students' mathematical reasoning skills in grade VIII SMP Negeri 1 Watubangga.
8. The students' mathematical reasoning skills are taught using Realistic Mathematics Education model (RME) did not differ significantly compared to students taught by Problem-Based Learning (PBL) model.
9. The students' mathematical reasoning skills are taught using Realistic Mathematics Education model (RME) better than students taught by direct learning model.
10. The students' mathematical reasoning skills taught using Problem-Based Learning (PBL) models are better than those taught by direct learning models.
11. Student activity during the learning process using Realistic Mathematics Education (RME) model and problem based learning (PBL) model shows that students are very active.

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