The Effect Of Problem Based Learning Model On Mathematical Representation Ability In Term Of The Initial Capabilities Of Grade VIII Students Of Public Junior High School Pekanbaru

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Abstract: This study aimed to determine the effect of problem based learning models on the ability of mathematical representation in terms of students' initial abilities. This type of research was experimental research. The study population was Public Junior High School students of class VIII Pekanbaru with medium school level. The sampling technique used random sampling. The research sample consisted of 34 experimental class students and 35 control class students. The initial abilities of students are categorized into three namely high, moderate, and low. The results showed that the mathematical representation ability of students who learn by using problem based learning models was better than students who learned by conventional learning. Based on the hypothesis test for high initial ability obtained sig. 0.330> 0.05 then H_0 was accepted. So that, it can be concluded that the mathematical representation ability of students who have high initial abilities and learn problem based learning models and those who study with conventional learning were not significantly different. From the U test results for initial ability, sig is being obtained. 0.042 <0.05 and T test results for low initial ability obtained sig. 0.031 <0.05. Means H_0 was rejected. It can be concluded that the mathematical representation ability of students with moderate and low initial ability who learn with problem based learning models was better than students who learn with conventional learning. Based on the interaction graph, there was no interaction between the learning model and the initial ability to affect student's mathematical representation ability.

Keywords: Mathematical Representation Ability, Initial Ability, Problem Based Learning Model.

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1 INTRODUCTION

One of the abilities students must have in learning mathematics is the ability of mathematical representation. This ability is very necessary to solve mathematical problems because the results of mathematical problem solving are interpreted in the form of symbols, equations, words, pictures, tables, graphs and manipulative objects. As Brenner stated (Neria & Amit, 2004: 409) that successful problem solving processes depend on mathematical presentation skills in words, graphs, tables, and equations, symbolic resolution and manipulation. In line with this opinion Cai, Lane and Jacabcsin (Syarifuddin, Irwan, & Asmar, 2018) stated that representation is the way a person uses to express the answer or mathematical idea in question.

The students' mathematical representation ability is indicated so it needs to be improved. Surya (2011) found that most of the SMP / MTs students could not represent the story problem correctly to solve the mathematical problem. In addition, a preliminary study of Hutagaol's research (Wahyuni, 2012) stated that the underdevelopment of students' representation power, especially junior high school students, was because students were never given the opportunity to do their own representation, but had to follow what the teacher had exemplified. Based on the test problems the students do not have good mathematical representation, for example representing problems in the form of images, the use of symbols and problem solving processes that are not appropriate.

Mathematical initial ability describes the readiness of students in receiving lessons to be delivered by the teacher. At the higher level of difficulty of mathematics subject matter, mastery of certain material is required as initial knowledge. Therefore, the initial ability of students gained from learning experiences is very important to know students' learning provisions in receiving new knowledge to be learned next. This is in line with the opinion of Ruseffendi (2004: 10) which says that the success of students in a lesson or education also depends on the readiness of students. There are two kinds of readiness of students, namely their mental development is ready and their prerequisite knowledge is possessed.

The results showed, the initial ability of students will affect students in receiving subject matter (Lestari, 2017). Students who have high initial abilities will more easily understand the material by linking the ideas they have to find the concepts of the material being studied. Meanwhile, on the other hand students who have low initial ability have a little difficulty in understanding the material to be learned.

Transferring knowledge to students who place teachers as centers is now less effective because it is only able to form students who are smart in theory but poor in their understanding and application in daily life. In order for students to be active in the teaching and learning process, they need to be given regular assignments to give them the opportunity to practice the skills and knowledge they have acquired (Syarifuddin, 2014). There is a need for a learning plan that enhances students 'mathematical representation and problem solving abilities that also pay attention to students' initial abilities before learning. One of them is a problem based learning model.

The problem based learning model places students at the center of learning activities. The teacher only functions as a facilitator who guides students in constructing their knowledge. Through the construction process, it will certainly make students develop their mathematical abilities. Suyatno (in Permendikbud No. 59 of 2014) states that problem based learning (PBL) is a learning process based on real life problems, students are stimulated to study problems based on their prior knowledge and experience (prior knowledge) to form new knowledge and experience. Provision of problems at the beginning of learning aims to arouse students' curiosity of the intended learning because students directly know the usage of the material in their lives. In terms of Afdarni's research (2017), in the problem based learning model students are encouraged to be able to further improve their own problem solving abilities through materials facilitated by the teacher and with teacher guidance.

Problem Statement

Is the mathematical representation ability of students who take learning with problem based learning better than those who follow conventional learning? This will be reviewed from three levels of initial ability of students, namely: high, medium, and low.

2 LITERATURE REVIEW

1. *Problem Based Learning Model*

The problem based learning model has the characteristics of using real life problems as the beginning of student learning to train and improve critical thinking and problem solving skills and discover important concepts. The teacher's duty is to help and direct students to achieve these skills. Arends (Abbas, 2000: 13) also stated that the problem based learning model is a learning model by independent students using a student learning approach to authentic problems so students can construct their own knowledge and develop higher skills.

Table 1
Steps in *Problem Based Learning Model*

Fase	Indicator	Teacher's Treatment
1	Students orientation toward problem	Explain learning objectives, propose phenomena or demonstrations or stories for the problems and motivates students to get involved in the problem solving activity.
2	Organize student to study	Helping students define and organizing related learning tasks with the problem given
3	Guide experience individual / group	Encourage students to gathering information accordingly, conduct experiments to get an explanation and problem solving
4	Develop and present the work	Help students in plan and prepare discussion works such as reports, and help students to share assignments with friends
5	Analyze and evaluate the problem solving process	Help students to reflect on learning that they havedo and evaluate their investigation and process they use.

Source: Rusman, 2017

2. Conventional Learning

Learning that is most often applied in schools is conventional learning. Conventional learning is considered as practical learning and does not require a lot of facilities to support learning resources. The conventional teaching and learning process generally takes place in one direction which is the transfer or transfer of knowledge, information, norms, values and others from a teacher to students. Conventional learning is teacher-oriented learning.

3. Representation Ability

One of the competencies that students must have in learning mathematics is the ability to represent. According to Dewanto (Aisyah, 2012: 17) representation is a model or substitute form of a problem situation or an aspect of a problem situation that is used to find solutions, for example, a problem can be represented by objects, images, words, or mathematical symbols. Representation contains three aspects, namely visual, mathematical expression, and word representation (Syarifuddin, Irwan, & Asmar, 2018). From this definition it can be explained that representation is an expression of mathematical ideas displayed by students as models or substitute forms for a problem to find solutions to the problems that are being faced and can be represented through pictures, words (verbal), tables, concrete objects or mathematical symbol.

Indicators of achieving the ability of representation mathematical that will be used in this research is as follows.

a. Present data or information from an issue to representation of images, diagrams, graphs or tables.
b. Resolve problems that involve expressions mathematical.
c. Write down the steps to solve the problem mathematics with words.

4. Initial Ability

Every individual has different learning abilities. This needs to get the attention of the teacher before carrying out learning, because the learning process will more or less be influenced by the ability to learn. According to Atwi Suparman (2001: 120) the initial ability is the knowledge and skills that students have so they can follow the lessons well. This initial knowledge is the readiness of students before learning.

3 METHODOLOGY

The research used in this research was *Randomized Control Group Design*. This study involved two sample groups namely the experimental class was given a problem based learning model treatment while the control class was given

conventional learning. To determined the effect of the treatment in several variables on the ability of representation and mathematical problem solving, a *Factorial Design* research design was used.

Table 2
Research Design

Class	Treatment	Post Test
Experiment	X_1	T
Control	X_2	T

Keterangan:
X_1 : treatment of problem based learning model
X_2 : conventional learning treatment
T : representation ability test

Table 3
The Relationship between Learning Models and Initial Abilities with Mathematical Representation Ability

Initial Abilities	Mathematical Representation Ability (Y_1)	
	Experiment (X_1)	Control (X_2)
High (A_1)	$X_1Y_1A_1$	$X_2Y_1A_1$
Moderate (A_2)	$X_1Y_1A_2$	$X_2Y_1A_2$
Low (A_3)	$X_1Y_1A_3$	$X_2Y_1A_3$

1. Population and Research Sample
The population in this study were all students of class VIII at State Junior High Schools in Pekanbaru City with the category of medium level schools in the 2019/2020 Academic Year totaling 28 schools. In determining the research sample used the *Random Sampling* technique. VIII.2 class was chosen for SMP Negeri 12 Pekanbaru as an experimental class and class VIII.3 SMP Negeri 18 Pekanbaru as a control class.

2. Development Instrument
So that the test of the ability of representation is given precisely, then content validity is carried out, testing the questions, and analyzing the questions after being tested. The results of the test run empirical validity tests, distinguishing items, item difficulty index, item acceptance classification, and question reliability.

3. Data Analysis
Data analysis to test the research hypothesis was using the t test statistic, the Mann-Whitney U test, and the two-way ANOVA test. Before testing the hypothesis, the basic assumptions were tested first, the normality test and the homogeneity test..

4 RESULTS AND DISCUSSION

The representation ability test given consists of two essay questions, each of which consists of three indicators of mathematical representation ability. The calculation results of the mathematical representation ability tests of students who have high, medium, and low initial abilities are described as the following table.

Table 4
Descriptive Statistics of Representation Ability Test Results Mathematically Based on Students' Initial Ability

Charac-teristic	Kemampuan Representasi Matematis					
	High Initial Ability		Medium Initial Ability		Low Initial Ability	
	X_1	X_2	X_1	X_2	X_1	X_2
N	6	8	20	20	8	7
Min.	83,33	66,67	66,67	41,67	41,67	33,33
Maks.	100	100	100	100	100	75
$\bar{x}$	97,22	89,58	86,25	75,42	68,75	46,43
St.Dev	6,80	15,26	13,04	18,03	20,29	14,31

Source: The Result of Data Processing (2020)

From the results of these calculations, the highest average mathematical representation ability obtained by the experimental class students with high initial ability. The worst results were obtained by control class students with low initial ability. The average value of the experimental class students was higher than the control class students.
Before testing the hypothesis, the prerequisite tests are normality and homogeneity tests. The test results are described as follows.

Table 5
Normality Test Results Value of Representation Ability Tests Sample Class Students

No	Classification Initial Abilities	Class	Score sig.	Explanation
1	High	Experiment	0,000	Not Normal
		Control	0,001	Not Normal
2	Medium	Experiment	0,029	Not Normal
		Control	0,055	Normal
3	Low	Experiment	0,200	Normal
		Control	0,172	Normal

Source: The Result of Data Processing (2020)

Homogenity test was performed only for normally distributed data ie students with low initial ability obtained sig values 0.209> 0.05, then HO is accepted so that it can be concluded that the data was homogeneous. Furthermore, homogeneous data was performed T test for hypothesis testing. Data that was not normally distributed followed by the Mann-Whitney U test for hypothesis testing. Based on the Mann-Whitney U test with high initial ability classification, sig values were obtained. 0, 0.330> 0.05 then H_0 was accepted so that it can be concluded that the mathematical representation ability of students who have high initial abilities who learn by problem based learning models and who learn by conventional learning are not significantly different.
From the results of the Mann-Whitney U test for initial ability, sig was being obtained. 0.042 <0.05 and T test results for low initial ability obtained sig. 0.031 <0.05 then H_0 was rejected so it can be concluded that the mathematical representation ability of students with moderate and low initial ability who learn with problem based learning models is better than students who learn with conventional learning. Whether there was an interaction between the learning approach and the

student's initial ability to influence students' mathematical representation ability, can be seen from the graph in the following figure:

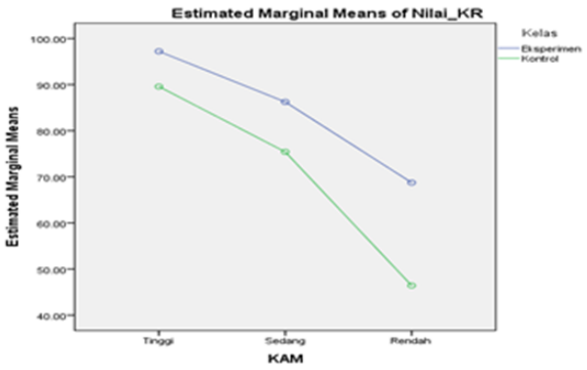

Fig.1. Mathematical Representation Ability in Term of Learning Model and Initial Ability

Based on the interaction graph because there is no line intersection, it can be concluded that there is no interaction between the learning model and the initial ability to influence students' mathematical representation abilities. Representation is part of the process of constructing mathematical ideas. With representation, students consolidate their ideas in a symmetric way. In general, representation helps in simplification of learning mathematical knowledge. Students who develop knowledge independently with the teacher's role as a facilitator will be able to develop mathematical abilities. Learning with problem based learning model can accommodate learning strategies in view of constructivism including active learning that provides a reality, involving students in the learning process, and helps make concepts more concrete (Fitri, 2017: 64). In problem based learning a learning environment where the problems that control learning, meaning learning begins with contextual problems that must be solved, and problems raised so that students need to gain preliminary knowledge before they solve problems. So students interpret problems, gather necessary information, evaluate alternative solutions, and present solutions, so that overall students construct their own knowledge with the help of the teacher as a facilitator.

The results of this study illustrate that the problem based learning model is proven to provide a good contribution in developing the mathematical representation ability of students both students with high, medium, and low initial abilities. This is in line with Fitri's (2017) research in his findings that the problem based learning model has a better influence on students' mathematical representation ability than students who learn with conventional learning. Although the initial abilities of students differ, students who learn by using problem based learning models provide better representation ability results than students who learn with conventional learning. This is caused by differences in student intensity in working on mathematical representation problems. The more students work on mathematical representation problems, the better their mathematical representation abilities.

5 CONCLUSION

The mathematical representation ability of students with moderate and low initial abilities who learn by using problem based learning model is better than students who take conventional learning, where as students who have high initial abilities learn to use problem based learning model and conventional are not significantly different. There is no interaction between the learning model and the initial ability of students' mathematical representation abilities.

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