

The Increasing of Student's Mathematics Problem Solving Ability and Learning Motivation Through Problem Based Learning Model

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Abstract- The goals of this research was to analyze: (1) the increasing of students mathematics problem solving ability among students taught by problem based learning method and students taught by conventional method. (2) the increasing of students learning motivation among students taught by problem based learning method and students taught by conventional method, (3) interaction between learning approach with initial knowledge to the increasing of mathematics problem solving ability, (4) interaction between learning approach with initial knowledge to the increasing of students learning motivation. This research was quasi experiment. The population of this research was students of grade VIII MTs Al-Washliyah 31 Tanjung Beringin. Randomly, there were two class as the sample of research, namely class VIII-2 as experimental class with problems based learning approach and class VIII-3 as control class with conventional method. The instruments of this research were: test of mathematics problems solving ability, questionnaire of students learning motivation and observation sheet. The instrument was content valid, the reliability 0,823 and 0,8012 for mathematics problem solving ability and questionnaire of students learning motivation. The data analyzing of mathematics problem solving ability using ANAVA-two way, and the questionnaire of students learning motivation with *Mann-Whitney* test. The result of the research shown that (1) the increasing of mathematics problem solving ability and students motivation taught by problem based learning better that conventional method, (2) there weren't interaction among learning approach with students initial knowledge to the increasing of student mathematics problem solving ability and learning motivation

Keywords: *problem based learning, problem solving ability and students learning motivation*

I. INTRODUCTION

Basically education is important thing in human life. Education is an effort to do to help the development and the increasing of human life quality. To face the challenge of future in globalization era and sophisticated technology of communication at this time, the individual asked to have many skill and ability. There is some skill and ability must be covered, like problem solving ability. This ability is very important, because in daily life every human always face

many problems that must be solved and asking creativity to find the solution of the problems.

One of way to develop the problem solving ability for the students in education through mathematics learning. Suherman said that as a learning process, mathematics in school should have certain goals that must be reached by the students by guiding the teacher. [1]. The goals of mathematics learning in the school are made based on the function of mathematics subjects in the school, as tools, mindset and science. Furthermore Akfendi said that functioning of mathematics subject as a tool to form students mindset can be measure from the ability or the skill of students in mastery of mathematics subject matter or always called *Mathematical Proficiency* [2]. The mathematics proficiency are students skill and ability in problem solving, especially in mathematics problem solving. Furthermore Akfendi said that the researcher in mathematics education merged in *National Research Council* (NRC) think that five mathematics skill and ability should be mastered by the students as form of mastering mathematic totally. [2]. Because of that, mathematics learning process in the school must make students mastering five mathematics abilities.

But in fact found that the condition in mathematics learning have not meet the expectation, especially the low of students mathematics achievement. Yaniawati said that the result of *The Third International Mathematics and science Study Repeal* (TIMSS-R) found that in 38 countries, the achievement of Indonesia Junior high school students in grade 34 for mathematics. [3]. Hartono and friend said that the problem solving have role important in mathematics and should be the goals in mathematics education. But, the problem solving ability of students still need more attention. [4]. Some research and international evaluation like *Program for International Student Assessment* (PISA) and *The Third International Mathematics and science Study* (TIMSS) said that the level of students problem solving ability of Indonesia still low. Furthermore Hudoyo (2001) in Hartono and friends said that problem solving ability as follow: *Problem in mathematics is not just a task or question to be answered by the students but has a special meaning as well as involve two*

requirements: (i) must be understood by students and challenging, (ii) task can not be solved by a procedure already knew (non-routine) [4].

Based on interview and observation of researcher at October 5th, 2015 with mathematics teacher in class VII MTs Al-Washliyah 31 Tanjung Beringin, known that the students less interested in learning mathematics teach by the teacher in the class. When the teacher teaches mathematics, the students not focus for the explanation and playing in the class. Students think that mathematics is difficult subject so that the students not mastery in understanding mathematics subject. It caused the students are lazy to learn mathematics and the students not effort to learn seriously to mathematics subject. The students not motivated to following the subject and doing the exercise of mathematics that caused the low of student mathematics achievement.

Furthermore the researcher do the second observation in October 7th 2015 by giving diagnosis test to the students in class VII MTs Al-Washliyah 31 Tanjung Beringin in subject two variable of linearly equation system to see the problem solving ability of students. The result of test show that 83,2% from the total of students have difficulties in solving the problems of applying the form of two variables linearly equation system, 66,7% of students have difficulties in solving the story problems in application form that belonging to the real world, but 75,4% of students have difficulties in solving the problems in form problem solving belonging to the real world.

The difficulties faced by the student can be caused by the strategy or learning model which oriented to the traditional method that less placing and considering the students in learning process. The way of the teacher to transfer the learning subject is not suitable, both of strategy or the learning model that not suitable with the subject or caused the way of teaching not make the student happy. The factors make the diffiucalties in learning mathematics sthe caused low of students learning motivation. Actually, the learning motivation is the important factor in the activity and the success of student learning. The result of Bakar's study find that the student's learning motivation in education is very important. Without learning motivation, its impossible. So that, the role of motivation in learning process is effective in students. By the motivation, the students will have effort to solve the every task to reach the goal. [5]. The increasing of motivation means the speed of work in doing everything to reach the goals. There many strategies or mathematics learning model can be choose to faced the mathematics learning problems in the school. In choosing the strategy or learning model that will apply to solve the learning problems, the teacher must have effort to choose and formulating as exactly, furthermore actually the mathematics teacher in the school more understand the situation and condition of students in the school.

Miarso said that the strategy or learning model is the full learning approach in learning system such general guide and scheme of activities to reach to general goal of learning which

explaining in the view of philosophy or certain learning theories. [6]. Next, Sanjaya said that a learning process can be success to reach the goal is the result from interaction and interrelation of components that forming learning system. [7]. The components are the goal, subject matter, learning strategy, media and evaluation. Every component will influence the success of learning process and influence the success of reached the goal of learning. Based on opinion above, can be conclude that to reach the goal in learning process doing some way, one of it is by choosing the suitable learning model. One of it by applying problem based learning model. Hope this learning model can growing the problem solving ability through the habitually thinking and creative attitude in understanding and solving the mathematics problem. In the end the habitually thinking and creative attitude will give positive effect to the student attitude in facing their daily life. Through the problem based learning, the effort to increasing and repairing the thinking and creative attitude doing systematically by focusing the considering to the learning process of solving problem. Off course, this activity will give the big chance to all students to do creative activities in mathematics learning. So that, the students will be more develop or increase the mathematics problem solving ability and also increasing learning motivation.

The goals of this research to increasing the student's mathematics problem solving ability and learning motivation, because based on the result of initial observation to the student's mathematics problem solving ability and learning motivation is low and caused the low of learning result to the mathematics learning in MTs Al-Washliyah 31 Tanjung Beringin. Next, doing the research by make the title of research: The Increasing of mathematics Problem Solving Ability and Learning Motivation Through Problem based Learning Model in MTs Al-Washliyah 31 Tanjung Beringin.

II. METHOD

The research method use was *quasi experiment*. The place of the research in MTs Al Washliyah 31 Tanjung Beringin, grade VII (seven) in even semester in academic year 2016/2017. The schedule of research doing suitable with the schedule of mathematics subject in the class and the teacher is mathematics teacher in MTs Al Washliyah 31 Tanjung Beringin. The population of the study is all of students MTs Al Washliyah 31 Tanjung Beringin Academic year 2016/2017 in 3 class about 128 students. Based on taking the sample as randomly, the sample of research was class VII₁, about 40 students teach by problem based learning. Class VII₃, about 40 students teach by conventional method (expository). The technique of data collection by using two kind of instrument namely test and non-test and data analyzing use descriptive analysis and Inferential Statistics was Anava Two Way Test.

III. RESULT

Before used in the school, the instrument of research need to apply to the students out of sample to see the validity,

reliability, daya pembeda, and difficulty indeks. Then the instrument revised as the suggestion from validator. The analysis do in experiment class and control class namely test of initial mathematics ability of student, problem solving ability and student's learning motivation by using *software SPSS 16*. Then, the result of research are as foollows:

A. Description of mathematics Initial Ability

The goal of initial ability test was to know the high, mid and low ability before learning process and to see the change or the increasing of student's initial ability. Hopefully, there will be changed after the learning process, especially for the students with low of initial ability can be mid or low in mathematics ability. To get the frame of student's mathematics initial ability did the mean calculation and standard deviation. The result of calculation shown in Table 1.

Table 1 above give the frame that the mean score of mathematics initial ability for each sample class are same relatife. To know the equality of mathematics initial ability of

sample class, need to do analysis test namely: test of normality and test of homogenity. Below are the result of calculation for normality test of students mathematcis initial ability in Table 2.

Table 1 Mean and Standar Deviation Description of Students Mathematics Initial Ability of Experiment and Control Class

Class	N	Mean	Std Deviation
Experiment (Group of PCL)	40	43.875	21.85
Control Class (Group of Conventional)	40	42.50	17.61
Total	80	43.19	19.73

Explanation: Ideal Score of Mathematics Initial Ability was: 100

Table 2 Normality Test of Students Mathematics Initial Ability

Class		Tests of Normality						H ₀
		Kolmogorov-Smirnov ^a			Shapiro-Wilk			
		Statistic	Df	Sig.	Statistic	df	Sig.	
Score of Initial Ability	Experiment Class (group of PCL)	.112	40	.200 [*]	.981	40	.732	Accepted
	Control Class Group of Conventional)	.111	40	.200	.964	40	.221	Accepted

a. Lilliefors Significance Correction

Based on Table 2, it get the result of data analysis of students mathematics initial ability test of experiment group have significance score 0,200 and for control class have significance score 0,200. Both of significance score are greater than 0,05, so that the data of experiment and control group was normal distribution.

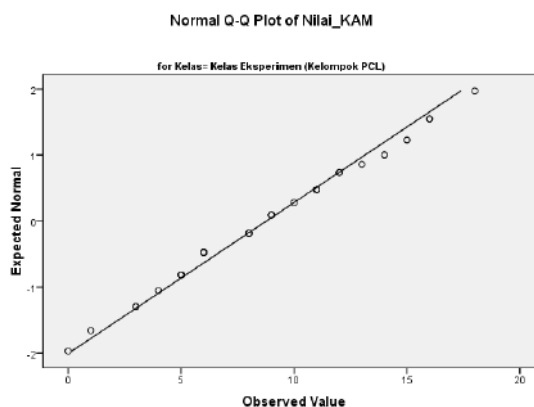


Figure 1 Normality Score of Mathematics Initial Ability

The interpretation result from *Normal Probability Plot* or *Normal Q-Q Plot* for mathematics initial ability score of experiment and control class above show that the point of data value lying around in a straight line, it shown in figure 1,

so that it can conclude that mathematics initial ability score for both learning model from population with normal distribution. For next, the calculation result of for homogeneity test of mathematics initial ability are show in table 3.

Table 3 Homogeneity Test of Students Mathematics Initial Ability

Test of Homogeneity of Variances			
Initial Ability			
Levene Statistic	df1	df2	Sig.
1.609	1	78	.208

From Table 3, it can see that significance value of *Levene* 1,609 statistic test about 0,208. The significance value greater than 0,05. So that, the data of experiment and control group are from variance of homogeneity data group. For next, do the test of mean difference for ability of experiment and control group by using T-test, the result of T-test in Table 4

Table 4 The Result of T-test of Students Mathematics Initial Ability of Experiment and Control Group

Independent Samples Test											
		Levene's Test for Equality of Variances		t-test for Equality of Means							
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
										Lower	Upper
Mathematics Initial Ability	Equal variances assumed	1.609	.208	.310	78	.758	.275	.888	-1.492	2.042	
	Equal variances not assumed			.310	74.634	.758	.275	.888	-1.493	2.043	

Based on the result of in table 4 above by using T-test at significance $\alpha = 0,05$ (two sided test, $1/2 \alpha = 0,025$) the result of $t_{\text{calculation}}$ about 0,310 by significance value 0,208 while t_{table} about 1,66. Because of $t_{\text{calculation}} < t_{\text{table}}$ ($0,310 < 1,66$) and significance $> 0,05$ ($0,208 > 0,05$), so H_0 can accepted. So it can be conclude that there is no mean difference of ability of experiment and control group. So that, the experiment and control group have same ability. After normality test, homogeneity, and mean difference test, then it need to group the students based on initial ability. The result of grouping can see in Table 5.

Table 5 The Group of Students Mathematics Initial Ability

Sample Class	Students Ability		
	High	Mid	Low
Experiment Class (PCL group)	8	26	6
Control (Conventional group)	7	29	4
Total	15	55	10

Based on table 5 above, it can be seen in experiment class that there are 8 students in high level, 26 student ini mid level, and 6 students in low level of mathematics initial ability, while in control class there are 7 students in high level, 29 in mid level and 4 students in low level of mathematics initial ability.

B. The Deskription of the increasing of Students Mathematics Problem Solving

The description of the increasing of students mathematics problem solving can see from the mean value of gain normalization. The mean score of gain are the frame of the increasing of students mathematics problem solving ability based on students mathematics initial ability (high, mid, and low) in problem based learning model and conventional method. The result of conclusion of mean score of gain normalization from the problem solving ability with problem based learning and problem solving ability with conventional method are shown in table 6.

Table 6 The Mean of Gain Score of Problem Solving Ability for PCL Group and Conventional Group Based on Students mathematics Initial Ability

Learning Model	Mathematics Initial Ability (total)	Problem Solving Ability	
		\bar{X}	Std
KPC	High (8)	0,75	0,22
	Mid (26)	0,78	0,32
	Low (6)	0,74	0,17
	Total (40)	0,76	0,24
KPV	High (7)	0,57	0,13
	Mid (29)	0,53	0,18
	Low (4)	0,47	0,17
	Total (40)	0,52	0,16

Note: maximum score for each test of problem solving ability:10

Based on table 6 above, it can see that the increasing of students mathematics problem solving ability by using Problem Based Learning model have mean score and standard deviation for high level 0,75 and 0,22, mid level 0,78 and 0,32, low level 0,74 and 0,17. While for the increasing of mathematics problem solving ability by conventional method have mean score and standard deviation for high level 0,57 and 0,13, mid level 0,53 and 0,18, low level 0,47 and 0,17.

To know the truth of significance from the CONCLUSION above, it need to do statistic test with Two Way of Anava. Statistic test with Two Way of Anava used to know the test of increasing of problem solving ability based on learning factor (KPC dan KPV) with factor of students

mathematics initial ability (high, mid and low) to the increasing of students mathematics problem solving ability.

C. Analysis of The Increasing of Mathematics Problem Solving Ability Based on Learning Factor and Students mathematics Initial Ability

Statistic analysis that used to know the increasing of students mathematics problem solving ability with Problem Based Learning higher than the students with conventional method, and there is no interaction between learning model and students initial ability to the increasing of mathematics problem solving by using Two way of Anova, the result of normality test of gain of problem solving ability show in Table 7.

Table 7 Normality Test of Gain of Problem Solving ability
Tests of Normality

Learning_Ffactor		Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	Df	Sig.
Gain_of Problem_solving	KPC	.126	40	.113 [*]	.929	40	.015
	KPV	.106	40	.200 [*]	.970	40	.348

a. Lilliefors Significance Correction

Based on table 7, it can see that the Problem Based Learning Model and Conventional Method (KPV) have significance score greater than 0,05 that is (0,113 > 0,05 and 0,200 > 0,05), so that the data of learning KPC and KPV have normal distribution. The calculation result of homogeneity for gain data group by using *software SPSS 16.0 Statistics* can see in table 8.

Based on Table 8, it can see that the significance statistics test *Levene* (3,397) about 0,069. That significance value greater than significance 0,05 (0,069 > 0,05). So that the data of both group learning KPC adn KPV from homogeny data group variance. The test result of Two Way ANAVA of gain of problem solving ability show in table 9.

Table 8 Test of Homogeneity of Variances Gain of Problem Solving Ability
Test of Homogeneity of Variances

Gain of Problem Solving			
Levene Statistic	df1	df2	Sig.
3.397	1	78	.069

Table 9 The Rangkuman Two Way ANAVA Test of Gain of Students Problem Solving Ability
Tests of Between-Subjects Effects

Dependent Variable: Gain_of Problem Solving

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1.175 ^a	5	.235	6.532	.000
Intercept	19.564	1	19.564	543.757	.000
Learning Factor	.675	1	.675	18.751	.000
Initial Ability	.023	2	.012	.326	.723
Learning Factor * Initial Ability	.015	2	.007	.203	.817
Error	2.662	74	.036		
Total	37.885	80			
Corrected Total	3.838	79			

a. R Squared = .306 (Adjusted R Squared = .259)

Based on Table 9 above, it can know that F at learning Factor (KPC and KPV) about 18,751 with significance value 0,000 less than significance 0,05, so that H_0 are rejected. In other words, there are the increasing of mathematics problem solving ability between students taught by problem based learning model comparing with the students with conventional method. So that, it can conclude that the increasing of mathematics problem solving between the students with problem based learning higher as significance comparing with the students with conventional method.

Based on calculation of Two Way Anava test the mean of gain normalization of problem solving ability in Table 9 can know that F at learning factor (KPC and KPV) about 18,751 with significance 0,000 less than significance 0,05, so H_0 are rejected. In other words, there is the increasing of mathematics problem solving ability between the students with problem based learning comparing with students with conventional method. So it can conclude that the increasing of students problem solving ability with problem based learning model (PCL) higher than the students with conventional method.

In Table 9, it can see that the learning factor that related with students ability with F score about 0.203 with significance score about 0,817 greater than significance 0,05, so that H_0 are accepted. So, it can conclude that there is no interaction between learning model (KPC and KPV) with students initial ability (high, mid and low) to the increasing of students problem solving ability. In other words, the increasing of problem solving ability caused of the difference of learning model are using not caused the students mathematics ability. As graphic, the interaction can see in figure 4.5.

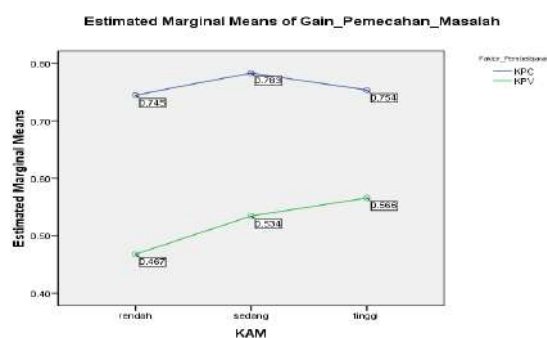


Figure 2 The interaction between Learning factor with students mathematics learning factor to the increasing of students mathematics problem solving

Based on Figure 2 above, it can see that there is no interaction between learning model and initial ability (high, mid and low) to the increasing of students problem solving ability. From the mean gain normalization score can see that the problem solving ability of students with problem based learning ability, for high level ability (0,75), mid level ability (0,78) and low level ability (0,74) higher than the students with conventional method, namely for high level ability (0,57), mid level ability (0,53) and low level ability (0,47). For the next, the mean difference of students mathematics problem solving ability of students with problem based learning model (KPC) and conventional method (KPV) for high level ability about 0,18, mid level ability about 0,25 and low level ability about 0,27.

D. Descriptive Analysis of Questionnaire of Students Learning Motivation.

The test of the questionnaire of students learning motivation in experiment class 1 are followed by 30 students. The application of test done by the student itself. For more clearly, the percentage of the questionnaire of students learning motivation of the students with problem based learning and conventional method can see in Table 10.

Table 10 percentage the questionnaire of students learning motivation with problem based learning and conventional method

No	Interval score	Kategori	Experiment		Conventional	
			Freq	Percentage	Freq	Percentage
1	102 < S ≤ 120	Very high	27	90%	0	0%
2	84 < S ≤ 102	High	3	10%	0	
3	66 < S ≤ 84	Mid	0	0%	25%	83,33%
4	48 < S ≤ 66	Low	0	0%	5	16,67%
5	30 < S ≤ 48	Very low	0	0%	0	0%

From the data before, it can be conclude that there are the different of student's learning motivation in class with problem based learning and conventional method, and also can be conclude that student's learning motivation with problem based learning better than conventional method.

IV. CONCLUSION

Based of result of research, there are some conclusion that answering the questions in research. The conlcution are:

1. The increasing of student's mathematics problem solving ability that giving PBM model higher than conventional method.
2. The increasing of student's learning motivation that giving PBM model higher than students that giving conventional method.
3. There are no interaction between learning and student's mathematics initial ability to the increasing of mathematics problem solving ability and students learning motivation.

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