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The Influence of Problem Based Learning on The Mathematical Problem Solving And Connection Ability of Students In SMP Swasta Assisi Siantar

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Abstract : *The purpose of the research is to determine: (1) the effect of problem based learning on the mathematical problem solving ability of students, (2) the effect of problem based learning on the mathematical connection ability of student, (3) the interaction of learning with mathematics early ability on the mathematical problem solving ability of students, (4) the interaction of learning with mathematics early ability on the mathematical connection ability of students, The kind of this research is quasi experiment. The population of this research is all students of SMP Swasta Assisi Siantar. The sample of research was taken randomly as many as 2 classes amounted to 76 students. The analysis is used by using t test and 2 way anava. The results of this research shows that: (1) there is effect of problem based learning on the mathematical problem solving ability of students, (2) there is effect of problem based learning on the mathematical connection ability of student, (3) there is no interaction of learning with mathematics early ability on the mathematical problem solving ability of students, (4) there is no interaction of learning with mathematics early ability on the mathematical connection ability of students*

Keywords: *problem based learning, direct learning, mathematics early ability, problem solving ability, connection ability*

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I. Introduction

Problem solving ability is a basic activity for students as well as a major focus of the mathematics curriculum. This is consistent with the purposes of mathematics learning formulated by the National Council of Teachers of Mathematics (2000:7), namely: (1) learning to communicate (mathematical communication), (2) learning to reason (mathematical reasoning), (3) learning to solving problems (mathematical problem solving), (4) learning to connect ideas (mathematical connections), and (5) the formation of positive attitudes toward mathematics (positive attitudes toward mathematics). Suryadi (2003:83) in his survey about the current situation on mathematics and science education in Bandung sponsored by JICA, stated the discovery that: "Mathematical problem solving is one of the mathematics activities that are considered important by teachers and students at all levels ranging from elementary to high school". Therefore, problem solving ability in mathematics need to be trained and familiarized to students as early as possible. This is as stated by Ruseffendi (1991: 291) that problem solving ability is very important, not only for those who later will go into math but also for those who will apply them in other fields of study as well as in everyday life.

The fact that the problem solving ability is poor is evidenced by the results of the Program for International Student Assessment (PISA) test. Indonesia is one of the participating countries of PISA. The distribution of students' mathematics ability in PISA 2003 is level 1 (49,7%), level 2 (25,9%), level 3 (15,5%), level 4 (6,6%), and level 5 - 6 (2.3%). At level 1 students are only able to solve mathematical problems that require one step. Proportionally, out of every 100 junior high school students in Indonesia only about 3 students reach level 5-6. Low problem solving ability of students can also be seen from the report of Trend in International Mathematics and Science Study (TIMMS) which states that the ability of Indonesian students in problem solving only 25% compared to countries such as Singapore, Hongkong, Taiwan, and Japan which is already 75% and based on the result of MIPA research reporting mathematics rank of Indonesia with SMP class 2: 1999 rank 34 from 38 participants; in 2003 ranking 34 out of 45 participants; in 2007 ranked 36 out of 48 participants. The inability of students to solve problems as above is influenced by the low ability of problem solving students that need to be trained and familiarized to students as stock in solving math problems and problems found in everyday life.

In addition to problem-solving skills, the ability of mathematical connections is no less important in mathematics learning so it is necessary to be mastered by students. Hendriana (2014) suggests, in addition to the importance of having the ability of mathematical connections is in line with the nature of mathematics as a systematic and structured science that contains interrelated concepts. In the subject of mathematics, many teachers only teach concepts, without connecting them with other concepts or in everyday life. The ability of a mathematical connection is one of the learning goals that is very useful for students since mathematical topics are interrelated with each other as well as with other disciplines. In addition, mathematics has a relationship with the real world or everyday life. Therefore, in making students more successful in learning mathematics, teachers should provide more opportunities for students to see relationships.

NCTM (2000) states that mathematical connections help students to develop their perspectives, view mathematics as an integrated part rather than a set of topics, and recognize the relevance and application both in the classroom and outside the classroom. Sumarmo (2006) explains in more detail the capabilities classified in the mathematical connection ability of which are seeking the relationship of various representations of concepts and procedures, understanding relationships among mathematical topics, applying mathematics in other fields or in everyday life; understanding the equivalent representation of a concept, seeking the relationship of one procedure to another procedure in equivalent representation, and applying relationships between mathematical topics and between mathematical topics and topics outside mathematics. Thus the ability of mathematical connection is one of the high-level thinking ability whose existence is very important in learning mathematics.

In contrast to the reality in the field, Kusuma (2006) states the level of ability of junior third grade students in making mathematical connections is still low. From Ruspiani's research (2000: 130) shows the average value of mathematical connection ability of junior high school students (SMP) is still low, the average score is less than 60 at a score of 100, which is about 22.2% for students' mathematical connections with the subject 44.9% for mathematical connections with other fields of study, and 7.3% for mathematical connections with daily life. The ability of students to apply their mathematical knowledge in real life is still not satisfactory. From these findings, the problem of the students 'mathematical connections becomes a serious matter that must be addressed immediately, so that the students' competence on the desired basic competencies achieved in the current curriculum implementation can be eligible. The users of mathematical science agree that mathematics should be made accessible for all students. That is, mathematics should be presented as a connected discipline, and not as a collection of separate topics. Mathematics should be studied in a meaningful context that links it to other subjects and with students' interests and experiences (Herlan, 2006:2).

Seeing the importance of mathematical problem solving and connection ability controlled by students is different from the findings in the field that the two capabilities are still low and most learners are accustomed to learning activities in the form of memorization without accompanied by the development of problem solving and connecting. Suspected cause of the occurrence because of the pattern of teaching that has been used by teachers has not been too much help students. One of the learning models that is alleged to be in line with the characteristics of the issues found above and curriculum expectations that apply at the moment is a problem-based learning model. This model is an approach to learning learners the authentic problem (real) so that learners can arrange their own knowledge, cultivate high skills and inquiry, establish students, and increase their confidence (Trianto, 2009:92). One of the main features of the problem-based learning model is that it focuses on interdisciplinary linkages, with the intent of the problem presented may be centered on a particular subject but the student can review the issue from many facets or associate with other disciplines to solve it. Problem-based teaching is a teaching approach that uses real-world problems as a context for students to learn about critical thinking and problem-solving skills, and to acquire essential knowledge and concepts from subject matter (Nurhadi, 2004: 56). While Ibrahim et al (2000: 3) states that problem based instruction (PBI) is a learning model that presents to authentic and meaningful problem situations that can make it easier for them to conduct inquiry and inquiry. With the teaching of the problem-based learning model encourages students to learn actively, passionately and students will be more open to mathematics, and will realize the benefits of mathematics because it is not just focused on a particular topic being studied.

II. Method

This type of research is quasi experiment. The population of this research is all students of SMP Swasta Assisi Siantar. The sample in this research is all students of class VII-b and class VII-c. The students of grade VII-b were selected as experimental class and given problem based learning, while the students of class VII-6 as control class were given direct learning. Learning tools developed in this research were Lesson Plan (RPP), Student Activity Sheet (LAS) and research instrument. The instrument used consist of: (1) test of mathematics early ability (2) test of mathematical problem solving ability and (3) test of mathematical connection ability. After the test of mathematics early ability is done, next, data analysis is done as normality test by using

kolmogorov-smirnov test, the homogeneity test by using *levene* test and for test of mathematical problem solving and connection ability of the students using t test and two way Anava.

III. Result And Discussion

3.1 The Description of the Mathematics Early Ability

Before discussing the research data from the results of the test of mathematical problem solving and connection ability of the students, the researcher first discusses the results of the test of mathematics early ability of the students. This test was given to find out the equivalence of experimental and control groups, and to grouping students according to high, medium and low.

Table 1. Sample Research Distribution

Group	N	x_{min}	x_{maks}	$\bar{x}$	S
Experimental	38	4	20	10.84	4.523
Control	38	4	20	11.08	4.784

1.1.1 Normality Test of The Mathematics Early Ability

Table 2. The Result of Normality Test of The Mathematics Early Ability

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Class	Statistic	Df	Sig.	Statistic	Df	Sig.
Early Ability	Eksperimental	.118	38	.200*	.954	38	.125
	Control	.115	38	.200*	.952	38	.103

From the table 2 above we can see that the value of significance is greater than the level of significance value (sig.) A = 0.05. Where for experiment class 0.200> 0.05, while for control class 0.200> 0.05. This means that score data of the students from both groups of samples comes from normally distributed populations.

1.1.2 Homogeneity Test of The Early Mathematics Ability

Table 3. The Result of Homogenity Test of The Mathematics Early Ability

Levene Statistic	df1	df2	Sig.
.074	1	74	.786

Based on Table 3, giving significance score = 0,786 is bigger than α = 0,05. Therefore, both of sample come from the population that has homogeneity varians.

1.2 The Description of Students' Mathematical Problem Solving Ability

Problem solving ability test is essay test with quadrilateral material. The results of the problem solving ability of student in the problem based learning class and direct learning class showed that the average of students on the post-test result is 38,64 and 33. Standard deviation of each class is 5,69 and 5,38. Description of students' problem solving ability by using problem based learning devices can be seen in Fig 1.

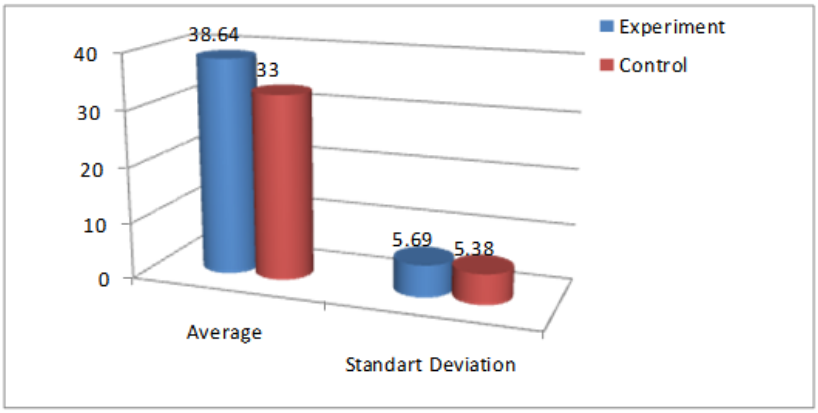

Figure 1. Average Post-test of Mathematical Problem Solving Ability

Based on Figure 1, can be concluded that post test scores of mathematical problem solving ability for direct learning groups are not very diffuse than post test scores for problem based learning groups.

1.3 The Description of Students' Mathematical Connection Ability

Connection ability test is essay test with quadrilateral material. The results of the connection ability of student in the problem based learning class and direct learning class showed that the average of students on the post-test result is 9,92 and 8,55. Standard deviation of each class is 1,66 and 1,88. Description of students' connection ability by using problem based learning devices can be seen in Fig 2.

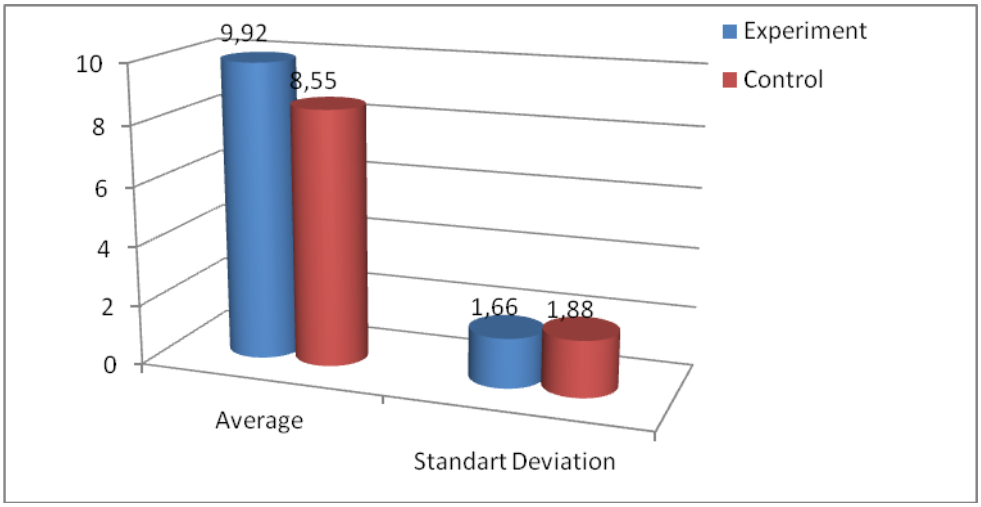

Figure 2. Average Post-test of Mathematical Connection Ability

Based on Figure 2, can be concluded that post test scores of mathematical connection ability for direct learning groups are not very diffuse than post test scores for problem based learning groups

3.3 Hypothesis Test

a. First Hypothesis

The test results showed that the sample came from the normal distributed population with the variance of each pair of homogeneous data groups, then the t test statistical analysis was performed. The statistic tested are:

$H_0 : \mu_{KPM(PBM)} = \mu_{KPM(PL)}$

$H_a : \mu_{KPM(PBM)} \neq \mu_{KPM(PL)}$

$\mu_{KPM(PBM)}$: Average mathematical problem solving ability of students with problem based learning

$\mu_{KPM(PL)}$: Average mathematical problem solving ability of students with direct learning

Table 5. The result of t test of The Mathematical Problem Solving Ability

		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
Problem Solving Ability	Equal variances assumed	.469	.496	4.429	74	.000	5.63158	1.27143
	Equal variances not assumed			4.429	73.777	.000	5.63158	1.27143

From the above output results can be seen that the value of significance is 0.000 < 0.05. This means there is effect of problem based learning on the mathematical problem solving ability of students.

b. Second Hypothesis

The test results showed that the sample came from the normal distributed population with the variance of each pair of homogeneous data groups, then the t test statistical analysis was performed. The statistic tested are:

$H_0 : \mu_{KK(PBM)} = \mu_{KK(PL)}$

$H_a : \mu_{KK(PBM)} \neq \mu_{KK(PL)}$

$\mu_{KK(PBM)}$: Average mathematical connection ability of students with problem based learning

$\mu_{KK(PL)}$: Average mathematical connection ability of students with direct learning

Table 6. The result of t test of The Mathematical Connection Ability

		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
Connection Ability	Equal variances assumed	.986	.324	3.353	74	.001	1.36842	.40810
	Equal variances not assumed			3.353	72.910	.001	1.36842	.40810

From the above output results can be seen that the value of significance is 0.001 < 0.05. This means there is effect of problem based learning on the mathematical connection ability of students.

c. Third Hypothesis

The test results showed that the sample came from the normal distributed population with the variance of each pair of homogeneous data groups, then the two way ANAVA test statistical analysis was performed. The statistic tested are:

$H_0 : (\alpha\beta)_{ij} = 0$

$H_a : (\alpha\beta)_{ij} \neq 0$

for $i = 1,2$

$j = 1,2,3$

$(\alpha\beta)_{ij}$: the interaction of learning with mathematics early ability on the mathematical problem solving ability

Table 7. The result of ANAVA test of The Mathematical Problem Solving Ability

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	1047.899[a]	5	209.580	8.028	.000
Intercept	72298.037	1	72298.037	2769.248	.000
Learning	448.799	1	448.799	17.190	.000
KAM	324.534	2	162.267	6.215	.003
Learning * KAM	133.829	2	66.914	2.563	.084
Error	1827.523	70	26.107		
Total	100366.000	76			
Corrected Total	2875.421	75			

From the above output results can be seen that the value of significance is 0.084 > 0.05. This means there is no interaction of learning with mathematics early ability (KAM) on the mathematical problem solving ability of students.

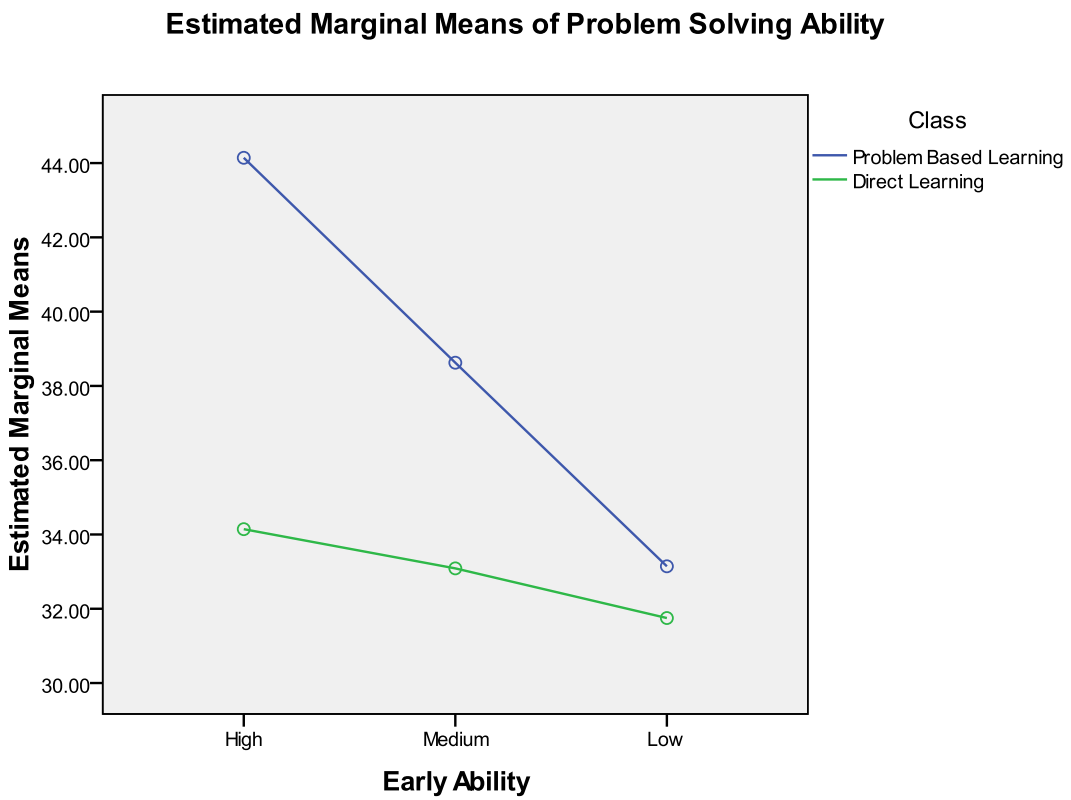

Figure 3. There is No Interaction Between Mathematical Problem Solving Ability Based on Learning Model and Early Mathematical Ability

d. Fourth Hypothesis

The test results showed that the sample came from the normal distributed population with the variance of each pair of homogeneous data groups, then the two way ANAVA test statistical analysis was performed. The statistic tested are:

$H_0 : (\alpha\beta)_{ij} = 0$

$H_a : (\alpha\beta)_{ij} \neq 0$

for $i = 1,2$

$j = 1,2,3$

$(\alpha\beta)_{ij}$: the interaction of learning with mathematics early ability on the mathematical connection ability

Table 8. The result of ANAVA test of The Mathematical Connection Ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	66.718[a]	5	13.344	4.601	.001
Intercept	4850.894	1	4850.894	1672.567	.000
Learning	23.629	1	23.629	8.147	.006
KAM	27.264	2	13.632	4.700	.012
Learning * KAM	4.618	2	2.309	.796	.455
Error	203.019	70	2.900		
Total	6754.000	76			
Corrected Total	269.737	75			

From the above output results can be seen that the value of significance is 0.455 > 0.05. This means there is no interaction of learning with mathematics early ability (KAM) on the mathematical connection ability of students.

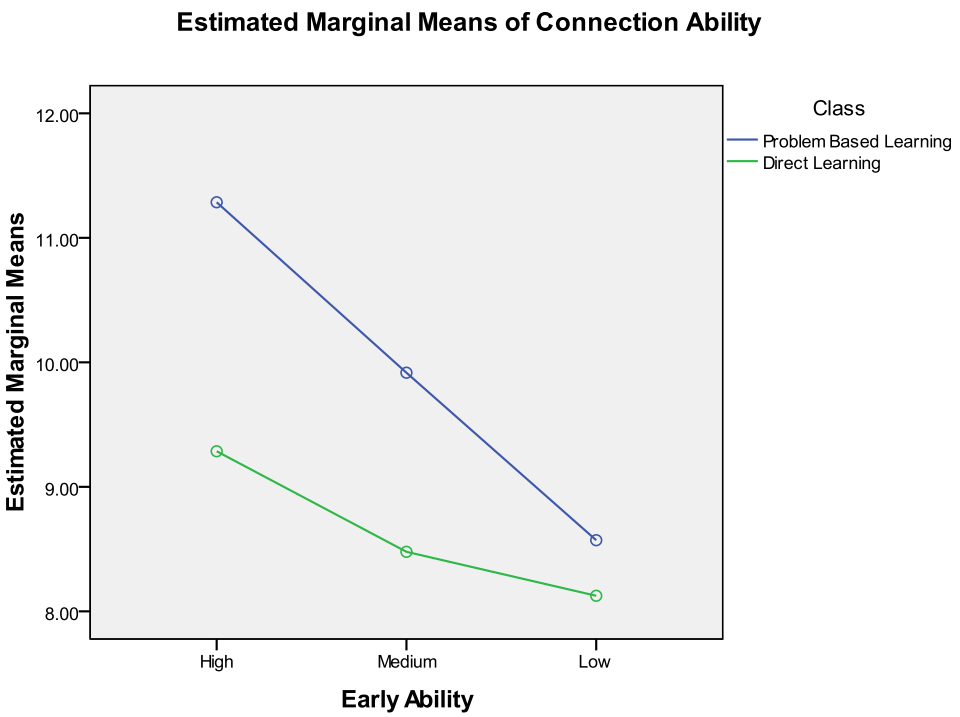

Figure 3. There is No Interaction Between Mathematical Connection Ability Based on Learning Model and Early Mathematical Ability

IV. Conclusion

Based on the results of data analysis research on the mathematical problem solving and connection ability of students who were taught with problem based learning then obtained some conclusions as follows:

1. there is effect of problem based learning on the mathematical problem solving ability of students
2. there is effect of problem based learning on the mathematical connection ability of student
3. there is no interaction of learning with mathematics early ability on the mathematical problem solving ability of students
4. there is no interaction of learning with mathematics early ability on the mathematical connection ability of students

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