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IMPROVEMENT OF COMMUNICATION SKILLS AND MATHEMATICAL DISPOSITION OF STUDENTS GIVEN A MODEL PROBLEM BASED LEARNING AND DISCOVERY

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Abstract
Communication skills and dispositions is very important mathematical owned by students to solve problems concerning mathematical concepts. In this study, analyzed the differences increase communication skills and dispositions given mathematical model of problem based learning and discovery. The method used in this research isquasi experiment and sampling techniques performed with simple random sampling.Inferential analysis of data performed by analysis of covariance, The results showed that increased communication abilities were given a mathematical problem based learning models larger than the discovery at 12.61. This is evident from the difference in value of the constant regression model of problem based learning is 31.89 and discovery that is 19.28, and increased by mathematical disposition of problem based learning models larger than the discovery of 12.41, This is evident from the difference score regression equation constant problem based learning models that 42.69 is greater than the discovery that 30.28,
Keywords: *Improvement, Communication Capabilities, Disposition Mathematically, Problem Based Learning, Discovery*

INTRODUCTION

In the content standards for units of primary and secondary education mathematics courses (National Education Minister Regulation No. 21 Year 2016 concerning content standards) has stated that the mathematics courses should be offered to all learners from primary schools to equip students with the ability to think logically , analytical, communication, systematic, critical, and creative, as well as the ability to cooperate**,** Mathematics is one of the subjects taught in schools have an important role in the development of communication skills and students' mathematical disposition. Therefore, the mathematical communication skills are very important in the learning of mathematics. With regards to the importance of the mathematical communication, on learning of mathematics discovered problem is lack of communication and student mathematical disposition.

Mathematical communication skills of students in Indonesia is still low. One indication of the difficulty in studying mathematics seen from the results of mathematical learning Indonesian, international survey results regarding the achievement of student learning outcomes Indonesia can be seen from the test results of the PISA (Program for International Student Assessment). According to the OECD, the results of PISA 2006 stated that Indonesia was rated 50th out of 57

participating countries with an average score of 391. The results of PISA 2009, Indonesia was ranked 61st out of 65 countries participating with an average score of 371 and final results PISA 2012, Indonesia was ranked 64th out of 65 participating countries with an average score of 375, while the average score of 500 international annually. From the results of the PISA study can be concluded that the results of students' mathematics learning in Indonesia is still low and even student achievement in Indonesia from year to year decline. Students still have the ability in mathematics, especially communication skills and the student has not regularly or used to work on the problems that are required to think more highly. Based on the bank on the fact the above problems, it is necessary to look for a model or approach to learning that can improve the ability of mathematical problem solving. One model of learning in a creative, innovative and effective in improving their communication skills and dispositions math students will researchers do is to use problem based learning model of learning and discovery. Students still have the ability in mathematics, especially communication skills and the student has not regularly or used to work on the problems that are required to think more highly. Based on the bank on the fact the above problems, it is necessary to look for a model or approach to learning that can improve the ability of mathematical problem solving. One model of learning in a creative, innovative and effective in improving their communication skills and dispositions math students will researchers do is to use problem based learning model of learning and discovery. Students still have the ability in mathematics, especially communication skills and the student has not regularly or used to work on the problems that are required to think more highly. Based on the bank on the fact the above problems, it is necessary to look for a model or approach to learning that can improve the ability of mathematical problem solving. One model of learning in a creative, innovative and effective in improving their communication skills and dispositions math students will researchers do is to use problem based learning model of learning and discovery.

As revealed earlier study by Marzuki (2017) to study differences in the problem solving and communication between students who were given a math problem based learning model with the discovery that the problem based learning (problem-based learning) can improve students' mathematical communication skills. Average communication skills students acquire mathematical problem-based learning model is 75.06, and the average communication skills students acquire mathematical discovery learning model is 49.56. Qodariyah and Eti (2018) with the title of the study to develop communication skills and mathematical disposition junior high school students through discovery learning concludes that the achievement and improvement of communication capabilities mathematics and mathematical disposition discovery learning students getting better learning than students who received conventional learning. Sovian, Sri and Sehatta (2018) with the title of the study students' mathematical communication skills and dispositions to learning model of discovery. Based on analysis of these data, conclude that there is the influence of students' mathematical communication skills and dispositions to learning discovery learning. With the increased capacity of 18% of the study before the given model of discovery learning.From the above description, the researchers interested in conducting research with the title

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"Differences in Improvement Communications And Disposition Mathematically Students Who Given Problem Based Learning Model With Discovery.

METHODE

This research was conducted at Al-Hidayah junior class VII which is located Jalan Lt. Sujono Gang College No. 4 Bandar Selamat Kec. Medan Tembung – Kota Medan. The research activities conducted in second semester of the school year of 2015/2016, the implementation is planned to take place in mid-April until May for 8 sessions (16 hours of lessons = 16 x 40 minutes) for each class of samples. The population in this study were all students of class VII Al-Hidayah field consisting of four classes that total students is 128 students. Sampling technique in this study conducted by random technique (simple random sampling). Random techniques (simple random sampling) is a technique that is done in a random sampling of the research. Thus, the samples in this study is a class VII-2 were 30 students and VII-3 amounted to 30 students. Class VII-2 uses problem based learning model learning and class VII-3 using the learning model of discovery.

This experimental study consisted of three phases: first, the preparation phase. At this stage, starting with the introduction are used to obtain the identification of the problem, formulation of the problem and required literature. So it can be determined that the study device used. Second, the preparatory phase of research begins with a device consisting of (1) learning model, (2) learning tools such as lesson plans, teaching materials and LAS, (3) research instruments. Furthermore, the election of the experimental class 1 and class 2 experiments as research subjects. Learning devices before tested beyond the first sample validated by a competent expert.Inferential statistical analysis was used to test in this study using analysis of covariance. The data will be analyzed in this study is the result of the pretest (prior knowledge of students) as concomitant variables and post-test results (end capability) as the dependent variable. The use of covariance analysis resulting in this study using concomitant variables as independent variables difficult to control but can be measured simultaneously with the dependent variable.

The description of the lines of inquiry that has been described above, can be described as follows:

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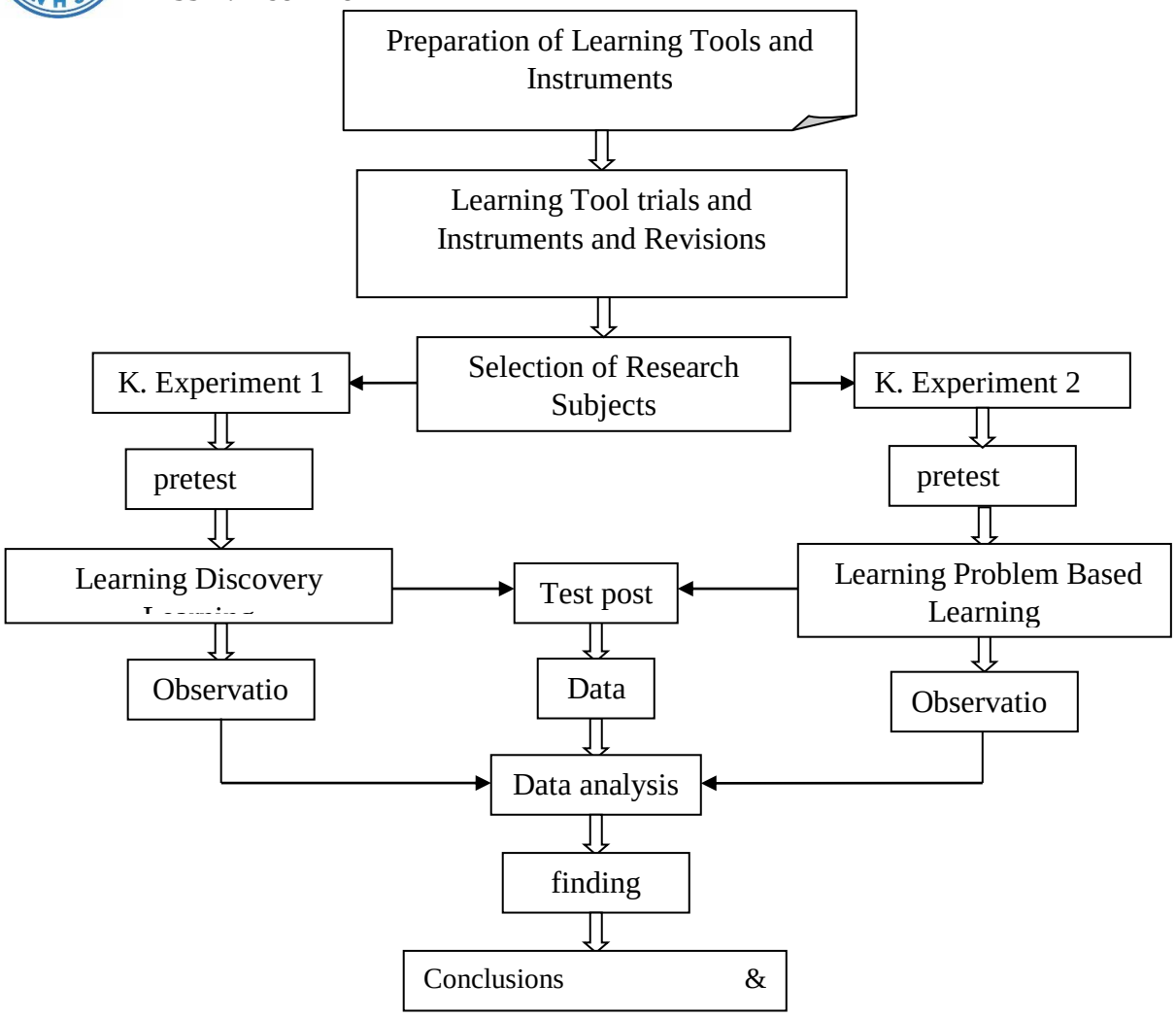

Figure 1. Flow

RESULTS AND DISCUSSIONS

The results of pre-test students' mathematical communication skills can be seen that the average pretest experimental class students problem based learning and discovery experiment different classes for each indicator communication. On average aspect declared the situation or image into a mathematical idea for an experimental class of problem based learning and classroom 8.34 7 experimental discovery, interpreting aspects of mathematical ideas into a written mathematical model experimental class of problem based learning 5.07 and discovery experiment class 4, 17 aspects of calculating problems solving and the concluding the experimental class problem based learning 4 and class discovery experiments 3.1 while the overall aspects of the experimental class of problem based learning 41.04 and 16.33 discovery experimental class. The average yield of the experimental class students' post test problem based learning and discovery experiment different classes for each indicator communication. On average aspect declared the situation or image into a mathematical idea for an experimental class of problem based learning 11.17 and 7.77 experimental class discovery, planning aspect interpret mathematical ideas written into the mathematical model experimental class of problem based learning 11.04 and experimental class discovery 8.8, aspects of calculating the completion of the problem and

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concluding the experimental class problem based learning 12,14 and 8.6 while the overall aspects of the experimental class of problem based learning 34.35 and 25.17 discovery experimental class.

The increase in each of the indicators in terms of overall higher in grade students are taught through discovery learning than classroom learning are taught through learning problem based learning. On the indicator says image or situation into a mathematical idea average N-Gain in problem based learning class is 0,084 while the class was 0,007. While the indicator to interpret the mathematical idea into a mathematical model, the average N-gain on problem based learning class is 0,025 while the discovery class is 0.453. In calculating the indicator of problem solving, the average N-gain on problem based learning class is 0,062 while the discovery class is 0.565. More details can be seen in Table 1 below.

Table 1. Data Improved Mathematical Communications for Every Indicators

Indicator	learning	
	Problem Based Learning	***Discovery***
Stating image or situation into mathematical ideas	0,084	0.007
Interpret the mathematical idea into a mathematical model	0,025	.453
Performing calculations to resolve issues	0,062	0.565

The average N-Gain disposition second mathematical learning groups that problem based learning and discovery for students of high category are respectively 0.323 and 0.295 with a standard deviation of 0.172 and 0.173. As for the category of being an average student-Gain N was lower than the high category students in learning problem based learning and discovery classes are 0.306 and 0.196 with a standard deviation of 0.128 and 0.223. Similarly, the lower category of students who have the highest N-Gain of the low category students and students of high category with the acquisition of N-Gain respectively are 0.342 and 0.333 with a standard deviation of 0.266 and 0.200. For the category of KAM was an increase in students' mathematical disposition higher on discovery learning than KAM medium and high categories in students by learning through problem-based learning and discovery. Descriptive there are some conclusions concerning:

Increased disposition of each of the indicators in terms of overall higher student in the classes taught by teaching problem based learning rather than classroom taught through discovery learning. On the confidence indicator the average N-Gain in problem based learning class is 0.216 while class discovery. is 0,025. While the flexibility indicator, the average N-gain in the problem based learning class is 0.102 while the discovery class is 0.014. On the persistence indicator, the average N-gain in the problem based learning class is 0.115 while the Discovery class is 0.016 and on the curiosity indicator, the average N-gain in the problem based learning class is 0.078 while the Discovery class. Is 0.022, and on a reflective indicator, the average N-gain in the problem-based learning class is 0.022 while the Discovery class is 0.011, the average application N-gain indicator in the problem based learning class is 0.156 while the discovery class is 0.023. The average Curiosity N-gain indicator in the problem based learning class is 0.135 while the Discovery class is 0.019. In detail can be seen in Table 2 below

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Table 2 Data Improvement Disposition Mathematically for Every Indicators

Indicator	**learning**	
	Problem Based Learning	***Discovery***
Confidence	.116	0,025
flexibility	0.102	0,014
Perseverance	0,115	0,016
curiosity	0.078	0,022
reflective	0,022	0,001
Application	0,156	0,023
Appreciation	0.135	0,019

To see the difference in the learning model of problem based learning and disvovery to improve communication skills and dispositions matesmtis students do with covariance test. The regression model obtained for the previous mathematical communication skills for this class of problem based learning ekprimen is $Y_{E1} = 31.89 + 0.140\ X_{E1}$, and the regression equation for experiment class disvovery is $Y_{E2} = 19.82 + 0.374\ X_{E2}$,Based on the linearity and parallelism test results met the regression model to examine differences in mathematical communication students who are taught by teaching problem-based learning with students taught by discovery learning. can be analyzed by analysis of variance Anacova as a modification. For the analysis the hypothesis formulated by guessing the distance both linear regression lines discovery experimental group and the experimental group problem based learning from each score the final assay results from the average score of the final test of the experimental group problem based learning and the final test scores of the experimental group discovery.

From the results of calculations for communication skills in Table 4.3 obtained $F^* = \frac{MSTR_{(adj)}}{MSE_{(adj)}} = \frac{136{,}398}{19{,}11} = 7.14$ and by Table F, for α = 5% is obtained $F_{(0,95,1:61)} = 4.00$. means $F^* \geq F_{(0,95,1:61)}$ so that $H_0 : r_1 = r_2 = 0$ is rejected. This means that there is a significant difference between students' mathematical communication skills which are subject to treatment learning problem based learning and students who are subject to discovery. To test the hypothesis that some of the required values are summarized in Table 3 below:

Table 3 Analysis of covariance for Complete Design Communications Mathematical Ability

Source of variation	**Sums of Squares or Products**			**Df**
	X	**Y**	**XY**	
Treatments	769.467	1209.368	408.934	1
Error	864.168	2400.168	566.168	58
Total	1633.635	3609.536	975.102	59
Source of variation	**adjusted SS**	**Adjust $$ ed Df**		
Treatments	136, 398	1		136.398

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Error	1108.435	57	19.11
Total	1244.833	58	

Mathematical communication skills gained significant value pretest (0.010) <0.05, then it can be concluded that the 95% confidence level, the results of the pretest posttest influenced by the ability of the student before being given learning problem based learning and discovery. Therefore, the error can be corrected by the value of the pretest as a covariate / covariance. While the results of the calculation of mathematical communication experimental class of problem based learning and discovery experiment class briefly described in Table 4 as follows:

Table 4 Analysis of covariance Mathematical Communications

Source	Type III Sum of Squares	Df	mean Square	F	Sig.
corrected Model	1396.815a	2	698 407	35 915	.000
Intercept	6320.886	1	6320.886	325 044	.000
Pretest	136 398	1	136 398	7014	.010
Class	1019.894	1	1019.894	52 447	.000
Error	1108.435	57	19 446		
Total	55609.000	60			
corrected Total	2505.250	59			

a. R Squared =, 558 (Adjusted R Squared =, 542)

Data result from the initial test and final test students' mathematical disposition regression equation for experiment grade problem based learning and discovery experiment class $Y_{E1} = 42.691 + 0.531\ X_{E1}$, and the regression equation for experiment grade discovery is $Y_{E2} = 30.28 + 0{,}655X_{E2}$, $F^* = 89.10$ and by Table F, for $\alpha = 5\%$ is obtained: F (1-.05), (1, n-2) = F (0,95), (1, 28) = 4.2. means $F^* \geq F\ (0{,}95),\ (1,\ 28)$, H_0 rejected and accepted H_a, This means that there is a positive effect (significance) the results of the initial test students' mathematical disposition (X) towards the end of the test results of students (Y) for the experimental class of problem based learning and discovery experiment class. The F test, for the disposition of problem based learning mathematical and experimental class discovery and class discovery experiments obtained F count was 30.691 with a significance level of 0.000. Because the probability (0.000) is much smaller than 0.05, meaning that both the linear regression model is not the same or differ significantly. While the results of test calculations mathematical similarity coefficient and disposition of problem based learning experimental class and experimental class discovery. From the results of calculations for the ability the disposition of the acquired $F^* = \frac{MSTR_{(adj)}}{MSE_{(adj)}} = \frac{582{,}028}{52{,}19} = 11.16$ and by Table F, for $\alpha = 5\%$ is obtained $F_{(0,95,1:61)} = 4.00$. means $F^* \geq F_{(0,95,1:61)}$ so that $H_0 : r_1 = r_2 = 0$ is rejected. This means that there is a significant difference

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between students' mathematical disposition capabilities are subject to treatment learning problem based learning and students who are subject to discovery learning. While the results of calculation of mathematical disposition experimental class of problem based learning and students who are subject to discovery learning using SPSS briefly described as follows:

The ability of a mathematical disposition obtained significant value pretest (0,002) <0.05, then it can be concluded that the 95% confidence level, the results of the pretest posttest influenced by the ability of the student before being given learning problem based learning and discovery. Therefore, the error can be corrected by the value of the pretest as a covariate / covariance. While the results of the calculation of mathematical communication experimental class of problem based learning and discovery experiment class briefly described in Table 5 as follows:

Table 5. Mathematical analysis of covariance Communications

Source	Type III Sum of Squares	Df	mean Square	F	Sig.
corrected Model	1907.428a	2	953 714	17 956	.000
Intercept	532 867	1	532 867	10 032	.002
Pretest	582 028	1	582 028	10 958	.002
Class	199 734	1	199 734	3,760	.057
Error	3027.506	57	53 114		
Total	329364.000	60			
corrected Total	4934.933	59			

a. R Squared =, 387 (Adjusted R Squared =, 365)

From the calculation, the increase in mathematical communication ability of students taught through problem based learning models are higher than students taught through discovery. Students who followed the students' mathematical communication skills are taught through the model has been used to actively solve problems thinking individually to get the concept. Because learning is not just a transfer of knowledge from teacher to student, but a process that is conditioned or attempted by teachers, so that students are active in a variety of ways to build their own knowledge. In line with Piaget that emphasizes the importance of motivation and facilitation of students by teachers. In order for a child's intellectual development can take place with the optimal then they need to be motivated and facilitated to build theories that explain the world around. In the model problem based learning teachers are required to facilitate and encourage students to be actively involved in the learning process so that they are able to develop knowledge for themselves.

Based on the analysis of data on the average pretest and posttest scores were then calculated for an increase in second grade, by model of problem based learning obtain N-Gain mean score of 0.337 and for classroom learning by discovery obtain N-Gain mean score of 0.124. The results of analysis of covariance calculation. This indicates that there are significant differences and at the above hypothesis is the difference in heights of the two regression lines are

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affected by the constant regression. Altitude regression lines describe student learning outcomes, namely when X = 0, the regression equation for mathematical communication of problem based learning class learning is obtained Y = 31.89 and the regression equation of learning discovery class learning is obtained Y = 19.82. Means it can be concluded that there are differences in the improvement of mathematical communication between students who are given problem based learning with discovery learning on the subject matter of square and rectangular. From the calculation, the increase in mathematical disposition of the students taught through problem based learning is higher than students taught through discovery. Students who follow the teaching of problem based learning has been used to actively solve problems thinking individually to get the concept. Because the learning process is not just a transfer of knowledge from teacher to student, but a process that is conditioned or attempted by teachers, so that students are active in a variety of ways to build their own knowledge so that confidence is greatly increased. Based on the analysis of data on the average pretest and posttest scores were then calculated for enhancement (N-Gain) both classes, classes taught through problem based learning models obtained a mean score of N-Gain 0.340,

The results of analysis of covariance calculation for mathematical disposition capabilities gained significant value pretest (0,002) <0.05, then it can be concluded that the 95% confidence level, the results of the pretest posttest influenced by the ability of the student before being given learning problem based learning. This indicates that there are significant differences and at the above hypothesis is the difference in heights of the two regression lines are affected by the constant regression. Altitude regression lines describe student learning outcomes, namely when X = 0, then the regression equation for the disposition of class mathematical problem based learning instructional obtain Y = 42.69 and regression equation discovery learning learning classroom obtain Y = 30.28.

CONCLUSION

There are differences between students' mathematical communication improvement by learning *problem based learning*with discovery and there is a difference between the mathematical dispositions increase student learning by problem-based learning by discovery.

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