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Differences of Mathematical Communication Ability between Problems Based Learning And Guided Discovery In Terms Of Students' Emotional Intelligence At Smp Kartika 1-2 Medan

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Abstract: *This study aims to determine: (1) Differences in mathematical communication ability between students taught by problem-based learning and guided discovery, (2) Differences in emotional intelligence between students taught by problem-based learning and guided discovery, (3) Interaction between models of learning and students 'early mathematical abilities of mathematical communication ability, and (4) the interaction between learning models and students' early math ability toward emotional intelligence. This research is semi experimental research. The population of this study are students of class VII SMP Kartika 1-2 Medan. And the sample of this research is class VII-1 and VII-2. Data analysis was performed with two way analyses of variance (ANAVA). The results showed that (1) There was a difference in mathematical communication ability between students that were given problem based learning with guided discovery. It can be seen from ANAVA result from Fcount = 14.31 bigger than Ftabel = 3.991. (2) There is a difference in emotional intelligence between students that are given problem-based learning with guided discovery. It can be seen from ANAVA result from Fcount = 344.86 bigger than Ftabel = 3,991. (3) There is an interaction between the learning model and the student's early mathematical ability to the mathematical communication ability. (4). There is an interaction between the learning model and the student's early mathematical ability to emotional intelligence.*

Keywords: *Problem Based Learning, Guided Discovery, Mathematical communication ability, Emotional Intelligence*

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I. Introduction

The ability of mathematical communication is one of the standard of ability that must be possessed by students as stated in the Regulation of the Minister of National Education Year 2006 on Graduates Competency Standards. Therefore, communication ability must be one of the aspects developed in the learning of mathematics. Greenes and Schulman (1996: 168) say that "Mathematical communication is: (i) the central force for students in formulating mathematical concepts and strategies; (2) the success capital for students of approach and completion in mathematical exploration and investigation; (3) for students in communicating with their friends to obtain information, share thoughts and inventions, brainstorm, assess and sharpen ideas to convince others ".

Further mentioned at least there are two important reasons, why communication with learning mathematics needs to be developed to develop among students. First, mathematics as language, meaning mathematics is not just a tool of thought, a tool for finding patterns, solving problems or drawing conclusions, but math is also an invaluable tool for communicating a variety of ideas clearly, precisely, Second, mathematics learning as social activity: that is, as a social activity in learning mathematics, as a vehicle for interaction between students, as well as a communication tool between teachers and students.

But in fact, the ability of mathematical communication with the field is still low. . Based on the problem of mathematical communication given to the students of SMP Kartika 1-2 Medan as many as 28 students as a sample. Only 3 students or (10%) write down what is known and asked in the question but it is incomplete and still wrong in planning and problem solving. While 27 students (90%) did not write the things that were known and asked and the adequacy of the data provided, only 6 students (20%) answered the problem correctly but did not follow the steps in solving the problem, most students lack understanding problem so wrong and unable to solve the problem well and correctly. This shows the ability of low student math communication.

This is also reinforced by Suryadi (2000) as follows: "The ability of Indonesian students in mathematics communication is very far below other countries, for example, for mathematical problems related

to mathematical communication ability, Indonesian students who successfully answered correctly only 5% under countries such as Singapore, Korea and Taiwan that reach more than 50%. "This addresses the low level of student communication ability.

In addition to students mathematical communication ability, students emotional intelligence in learning also contributes to the learning process. The learning process of school is a complex and thorough process. Emotional intelligence can be done if the students have an understanding of the material or concept and have the courage to do. This understanding can occur based on the result of rational thinking which is cognitive and intellectual intelligence, better known as Intelligence Quotient (IQ). Many people argue that to attract high achievement in learning, one must have a high IQ because intelligence is a potential stock that will facilitate the learning, and in turn will result in optimal learning achievement.

Although IQ is seen as a benchmark of one's achievement, the reality is that there are students that have high intelligence ability but have relatively low learning achievement, but there are students who, despite their relatively low intellectual ability, can achieve relatively high learning achievement. The level of intelligence is not the only factor that determines one's success, because there are other factors that influence. According to Goleman (Uno, 2005: 70), intellectual intelligence (IQ) only supports about 20% of the factors that determine success, while the remaining 80% comes from other factors, including emotional intelligence or Emotional Quotient (EQ). Emotional intelligence includes the ability to motivate yourself, overcome frustration, control the urge of the heart, control the mood (mood), empathy, and ability to work together.

According to Hasrattuddin (2011: 2), Emotional Intelligence is the ability of a person to control his own emotions and others, to distinguish one other emotion and use that information to guide the process of thinking and behavior. The same thing that is stated Goleman (Hidayat, 2014: 55), emotional intelligence is the ability of a person to manage his emotional life with intelligence (to manage our emotional life with intelligence); maintaining emotional harmony and expression through the ability of self-awareness, self-control, self-motivation, empathy and social ability. However, intelligence does not mean anything if the emotions are in power. Emotional intelligence adds much more qualities that make us more humane. Mathematical learning accompanied by grinding emotional intelligence of students is also expected to improve learning achievement, because emotions provoke one's actions against what he faced.

Student's mathematical communication ability can be grown with good learning process, lack of students' mathematical communication ability and low learning result in math learning can be influenced by mistake during learning process. This can be due to improper learning model or the ability of teachers in developing learning models less able to explore the communication ability and emotional intelligence of students.

Based on the above problems, allegedly need an improvement in the learning process of learning models that can improve the ability of mathematical communication in terms of students' emotional intelligence. There are many models of learning that we usually use in the effort to grow both capabilities, while the learning model is expected to be in line with the characteristics of mathematics that emphasize that the learning is no longer centered on the teacher but on the students. Referring to the less emphasized learning to make the students more active one of them is problem-based learning model and learning model Guided discovery.

Problem-based learning model is a learning model that uses the problem as a starting point (starting point) of learning. Nurhadi (wahyuni, 2013: 4) says problem-based learning is a teaching that uses real-world problems as a context for students to learn about critical thinking and problem-solving ability, and to acquire essential knowledge and concepts from subject matter.

Eggen and Kauchak (2012: 307) mentions problem-based learning is a set of teaching models that use problems as a focus to develop problem solving ability. According to Dewey (Trianto, 2011: 91) study based on the problem is the interaction between the stimulus with the response, is the relationship between the two directions of learning and the environment. The environment provides input to students in the form of help and problems, while the brain's nervous system functions to interpret the aid effectively so that problems encountered can be investigated, assessed, analyzed, and sought solving well.

In addition to the problem-based learning model (PBM), the discovery learning model is an activity or learning designed to enable students to discover concepts and principles through their own mental processes. According to Fate (2012: 47) which states that learning guided discovery will greatly affect students: develop creativity, gain hands-on experience, develop rational thinking ability, increase activity, learn to solve problems and get learning innovation. Furthermore Riska (2014) in his research stated that improving students' mathematical communication ability through learning guided discovery learning are better than students learning through conventional learning.

II. Research Methods

This study was a quasi experiment with the pretest-posttest two design design, ie experiment 1 class received treatment 1 and experiment 2 class received treatment 2. In this study, experimental class 1 was given PBL and experiment class 2 was given guided discovery (GD).

The population of this study is all junior high school students Kartika I-2 Medan. In the sample determination the initial step to be taken is to limit the type of population, or determine the target population. So the sample of the study is limited to VII grade students of SMP Kartika I-2 Medan sampling in this study was chosen two classes at random because based on information and teachers that the students' ability of each class evenly heterogeneous. One way of selecting samples representing the population is a simple random way, ie when every member of the population has equal opportunity to choose. The selected sample is the students of class VII-1 and VII-2 SMP Kartika I-2 Medan.

Samples of both the experimental class each divided by category Early Mathematical Ability (EMA) group of students of high, medium and low. Scores are used to determine the category of EMA of students gathered from EMA values were done before treatment. The instrument of this research is the description of the test form to measure students' mathematical communication ability and emotional intelligence questionnaire to measure students. Before to use, test and questionnaire was tested for validity and reliability first.

This research activity is carried out through the following stages. The preparatory stage includes: a) theoretical study of the variables to be studied ie mathematical communication and emotional intelligence, problem-based learning and guided discovery learning, and relevant research results; b) specify the sample and place of study; c) developing instruments and teaching materials; d) conducting instrument and instrument improvement trials. Implementation phase includes: a) implementation of learning and data collection through tests of mathematical communication ability and questionnaire emotional intelligence b) analyze data and conduct discussion. The stages of preparing the report include: a) preparing reports on research results; b) guidance of research results with supervisor.

III. Result And Discussion Of Research

EARLY MATHEMATICAL ABILITY (EMA)

EMA data were collected and analyzed to determine the students' early mathematical abilities prior to the study. This data is derived from a test consisting of 20 objectives with materials already studied in school. The test results in initial math ability as follows:

Table 1. Student Grouping by Category EMA

Class	Kemampuan Siswa			Total
	High	Medium	Low	
Class PBL	5	20	10	35
Class GD	6	21	8	35
Total	11	41	18	70

Based on the above table 1, the experimental class I obtained for the high category capability level 5 students, while 20 students, and low 10 students while for the experimental class II level of students' ability for high category 6 students, 21 students, and low 8 students.

MATHEMATICAL COMMUNICATION ABILITY

To obtain a picture of mathematical communication ability differences between PBL and descriptive guided discovery by looking at the difference in the average pre-test and post-test on students' mathematical communication skills. The calculation results can be seen from the following table:

Table. 2 Average Differences Pre Test and Post Test Communication Skills between PBM and Guided Discovery

Aspect	Average Pre Test Class PBL	Average Pre Test Class GD	Average Post Test Class PBL	Average Pre Test Class GD
Presents a written mathematical statement by the form of an image or description of a given contextual problem	2.04	2.02	3.16	3.04
Creating mathematical models of mathematical symbols, defining strategies and solving problems	2.01	2.01	2.95	2.85
Explain ideas, completion strategies or answers obtained	1.96	1.93	3.03	2.86

From table 2 it can be seen that the average score before the learning is done on average of all students in both classes is still low, but after the learning done there are improvement on all aspects of students' mathematical communication.

Where the indicator presents a mathematical statement by writing in the form of images or description of contextual problems given the average value of pre-test in the class PBL of 2.04, while the average value of

pre-test in the class of invention are guided by 2.02 and for the average value of post test in the PBL class of 3.16, while the average post test of the guided discovery classes is 3.04. In the indicator to make mathematical model in the form of mathematical symbol, to determine the strategy and solve the problem of the average value of pre test of PBL class equal as 2.01, whereas the average value of pre test of guided discovery class is 2.01 and for the average post test in grade PBL of 2.95, while the average post test of the guided discovery class is 2.85. And on the indicator Explain the idea, the strategy of completion or answer obtained the average value of pre-test in the PBL class of 1.96, while the average value of pre-test in the class of invention are guided by 1.93 and for the average post test in the PBL class of 3.03 , while the average post test of the guided discovery class is 2.96. It is clear that there is an increasing difference between the mathematical communication ability of the difference in the mean value of pre test and post test of mathematical communication ability. The test results showed that the data group of students' mathematical communication ability came from the normal distributed population with the variance of each pair of homogeneous data groups, then the two ANAVA statistical analysis was done. The results of the calculations are presented in Table 3 below:

Table 3 ANAVA Two Path Test Results

SourceVariance	JK	db	RJK	F_O	F_{tab}
Between A	176.01	1	176.01	14.31	3.991
Between B	3015.67	2	1507.83	122.57	3.140
Interaction AB	290370.31	2	145185.16	11802.12	3.140
In	787.30	64	12.30		
Total	294349.30	69			

For Hypothesis 1 that has been formulated used two path ANAVA using statistic F with formulas and criteria set. Based on Table 3, the value of F_0 14.31 greater than F_{table} 3.991 means that H_0 is rejected so that it can be concluded that the mathematical communication ability of students learning with problem-based learning model is higher than students that learn with guided discovery learning model.

For Hypothesis 3 that has been formulated used two path ANAVA using statistic F with formulas and criteria set. Based on Table 3 it is found that the value of F_0 for EMA category is 1507.83 with F_{table} 3.140 which means H0 is rejected. So EMA category has an effect on student's mathematical communication ability. From Table 3 it can also be seen that for learning factor and EMA, obtained F value for learning interaction and students' math early ability of 11.802,12 and F_{table} 3.140. Because $F_0 > F_{table}$, it can be concluded that reject H0 and thank Ha, which means there is interaction between learning model and EMA to students' mathematical communication ability. It can also be interpreted, there is a mutual influence provided by the learning model and EMA on students' mathematical communication abilities. More specifically, the interaction between the learning model and the student's early ability to students' mathematical communication abilities in the graph of the interaction can be seen in Figure 1 below:

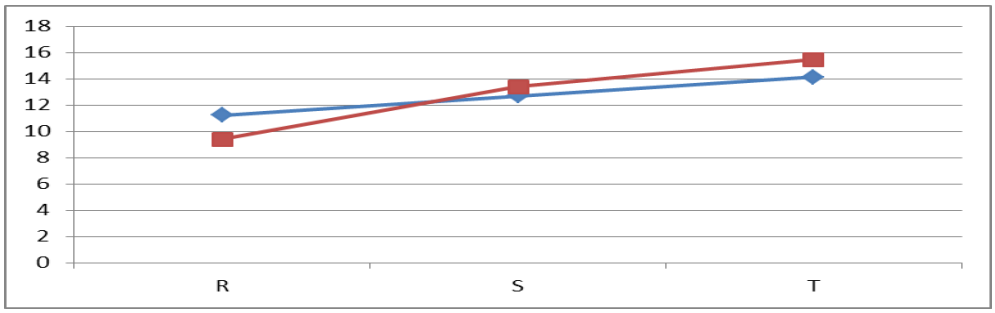

Figure 1 Interaction Between Learning and EMA on Mathematical Communication Ability

From Figure 1 above, it can be seen that there is an interaction between learning and students 'early ability to students' mathematical communication ability.

SCALE OF EMOTIONAL INTELLIGENCE

To get a picture of differences in the increase in emotional intelligence between PBL and descriptive guided discovery is to see the difference in the average pre test and post test on the emotional intelligence of students. The calculation results can be seen from the following table:

Table. 4 Differences Pre Test and Post Test Scale of Emotional Intelligence between PBL and Guided Discovery

Aspect	Average Pre Test Class PBL	Average Pre Test Class GD	Average Post Test Class PBL	Average Pre Test Class GD
Recognizing Emotions	1.9	1.7	2.86	2.49
Managing Emotions	2.1	1.9	2.77	2.5
Motivating Yourself	1.9	1.9	2.83	2.3
Recognizing the Emotions of Others	2.3	1.9	2.82	2.4
Building Relationships With Others	1.6	1.6	2.80	2.3

From table 4 it can be seen that the mean score before and after learning is done on the emotional intelligence scale, where the average of all students in the two classes is different. Where the indicator recognizes the emotion of the average value of pre test of the PBL class of 1.9, whereas the average value of pre test of guided discovery class of 1.7 and for the average post test on the PBL class of 2.86, while the average value of post test of guided discovery class of 2.49. On the indicator of managing the emotion of the average value of pre test of the class of PBL of 2.1, while the average value of pre test of the class of invention guided by 1.9 and for the average post test of the PBL class of 2.77, while the average value of post test of the guided discovery class of 2.5. Of self-motivating indicators, the average value of pre-test on the PBL class are 1.9, whereas the average pre test value of the guided discovery class is 1.9 and for the mean post test value of the PBL class is 2.83, whereas the average value of the post test of guided discovery class as 2.3. Of the indicator to recognize the emotions of others, the average value of pre-test of the class of PBL are 2.3, whereas the average value of pre test of guided discovery classes are 1.9 and for the mean post test in the PBL class is 2.82, post test of guided discovery classes of 2.4. And on the indicator foster relationships of others the average value of pre-test of the class PBL as 1.6, while the average value of pre test of guided discovery class as 1.6 and for the average value of post test in the class of PBM of 2.80, while the value of the average post-test in guided discovery classes is 2.3. It is clear that there is an increased difference between the emotional intelligence of the difference in mean pre test and post test values of emotional intelligence.

The results show that emotional intelligence data group of students come from normally distributed population of a variance between each pair of homogeneous data sets, we then performed statistical analysis ANAVA two lanes. The calculation results can be seen in Table 5 below:

Tabel 5 Hasil Uji ANAVA Dua Jalur

SourceVariance	JK	db	RJK	F_O	F_{tab}
Between A	7242.06	1	7242.06	344.86	3.991
Between B	5300.57	2	2650.29	126.20	3.140
Interaction AB	893891.63	2	446945.81	21283.23	3.140
In	1343.99	64	21.00		
Total	907778.26	69			

For Hypothesis 2 that has been formulated used two-way ANAVA using statistic F with the formula and criteria set. Based on Table 5, the value of F arithmetic 344.86 greater than F_{tabel} 3.991 means H_0 rejected so that it can be concluded that the emotional intelligence of students learning with problem-based learning model is higher than students that learn with guided discovery learning model.

For Hypothesis 4 that has been formulated used two-way ANAVA using F statistic with the formula and criteria set. Based on Table 5, it is found that the value of F arithmetic for EMA category is 126.20 with F_{tabel} 3.140 which means H_0 is rejected. So the EMA category affects the students' emotional intelligence. From Table 5 it can also be seen that for learning factor and EMA, we get F value for learning model interaction and student's early math ability 21283.23 and and Ftabel 3.140. Because $F_0 > F_{tabel}$, it can be concluded that reject H_0 and accept H_a, which means there is interaction between learning model and EMA on students' emotional intelligence. It can also be interpreted, there is a mutual influence provided by the learning model and EMA on students' emotional intelligence. More specifically, the interaction between the learning model and the student's early ability to emotional intelligence of students in graphic interaction can be seen in Figure 2 below:

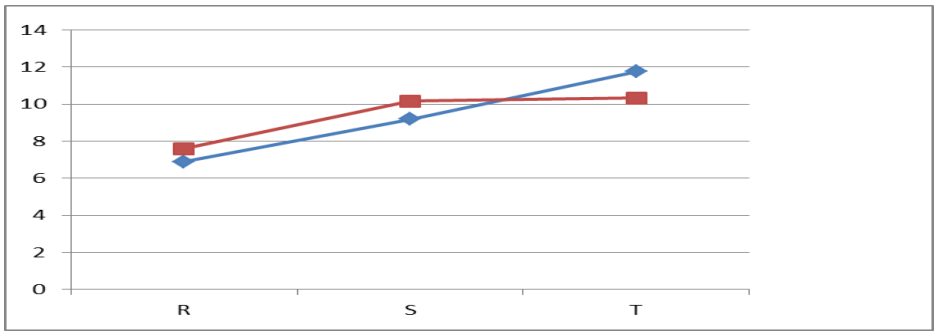

Figure 2 Interaction Between Learning Model and EMA on Student Emotional Intelligence

From Figure 2 above, it can be seen that there is an interaction between learning model and student's early ability to students' emotional intelligence.

IV. Conclusion

Based on the results of data analysis and research findings during problem-based learning and guided discovery with emphasis on mathematical communication ability and emotional intelligence of students, obtained some conclusions which are the answer to the questions about the formulation of the problem. The conclusions are as follows:

1. There is a difference in the improvement in mathematical communication skills between students that are given problem-based learning with students that are given guided discovery. Descriptively, the average of experimental group of problem-based learning in the indicator presents a written mathematical statement by the form of picture or description of the contextual problem given. There is an increase in 1.12, the indicator makes mathematical model in the form of mathematical symbol, determining the strategy and solving the problem has increased 0.94 , and the indicator explains the idea, the completion strategy or the answer obtained increased 1.07 and the overall indicator increased 3.13. As for the experimental group, the guided discovery in the indicator presents a written mathematical statement by the form of picture or description of the given contextual problem having an increase of 1.02, the indicator making mathematical model in the form of mathematical symbol, determining the strategy and solving the problem increased 0.84, and the indicator explaining the idea, settlement strategy or answers obtained increased 0.93, and overall indicators increased 2.79. In this case, the improvement in mathematical communication ability using PBM is better than guided discovery.
2. There is a significant improvement in emotional intelligence among students that are given problem-based learning with students that are given guided discovery. This can be seen from the analysis of variance (ANAVA) for F arithmetic is 344.86 smaller than F_{table} is 3.140.
3. There is interaction of learning model and difference of early math ability to improvement of student's mathematical communication ability. This can be seen from the analysis of variance (ANAVA) for F arithmetic is 11802.13 smaller than F_{table} is 3.140.
4. There is interaction of learning model and difference of early math ability to improvement of student's emotional intelligence. This can be seen from the analysis of variance (ANAVA) for F arithmetic is 21283.23 smaller than F_{table} is 3.140.

V. Suggestion

Based on the results of research, problem-based learning and guided discovery applied to learning activities provides important things for improvement, for which researchers suggest the following:

1. Learning that emphasizes student's activeness in learning to build his own knowledge should be preferred in mathematics learning so as to improve knowledge (cognitive) and attitude (affective)
2. The next researcher can use problem-based learning and guided discovery to improve other mathematical abilities such as problem solving, mathematical reasoning, mathematical connections, mathematical representations and so on.
3. The findings in the study indicate that the learning used have not been able to optimize the improvement in students' emotional intelligence attitude. One possible cause is the short research time to change the behavior of the students' emotional intelligence. For further researchers that want to research about emotional intelligence should consider to do research with a longer duration.
4. Problem-based learning and guided discovery requires a relatively large amount of time. In order for learning to occur systematically in accordance with the plan and effective utilization of time, the teacher should make the preparation of scenarios and careful planning on teaching materials used.

5. Should be used props in learning so that students more easily learn the subject matter and make it easier for students to complete the questions given.
6. In problem-based learning the role of the teacher is as a facilitator in the learning process, then the teacher should be able to create a fun learning atmosphere for students, giving opportunities for students to come up with ideas or ideas in their own way, students should also be given the opportunity to assess his friend's reply so that in learning the students becomes more courageous to express the right reasons for a thing, more confident and creative in communicating the discovery of the answer of a problem.

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