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Differences Of Students Mathematical Communication Ability Between Problems Based Learning, Realistic Mathematical Education And Inquiri Learning In Smp Negeri 1 Labuhan Deli

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Abstract: *This study aims to determine (1) Differences in the ability of mathematical communication between students taught by problem-based learning, realistic mathematics education, and inquiry learning, (2) The process of completion of answers made by students in solving problems of problem-based learning, realistic mathematics education, and inquiry learning. This research is semi experimental research. The population of this study is the seventh grade students of SMP Negeri 1 Labuhan Deli. The sample of this research is class VII-1, VII-2 and VII-6. Data analysis was performed by one-way analysis of the ANOVA. The results showed that (1) There were differences in mathematical communication ability between students taught by problem based learning, realistic mathematics education, and inquiry learning. This can be seen from the one-way ANAVA results from* $F_{arithmetic}$ *= 3.254 is greater than* F_{table} *= 3.08. (2) The process of completing students' answers to mathematical communication ability that are given problem-based learning is better than realistic mathematics education, and inquiry learning.*

Keywords: *PBL (Problem Based Learning), Realistic Mathematics Education, Inquiri Learning, and Mathematical Communication Ability.*

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I. Introduction

An education is said to be of quality if the educational processes can produce individuals or human resources that benefit society and nation development. Given that mathematics is one of science that underlies the progress of science and technology (science and technology), so that mathematics is seen as a science that is structured and integrated, the science of patterns and relationships, the science of how to think to understand the world around. In learning mathematics, students get the opportunity to develop systematic, logical and critical thinking in communicating ideas or solving of a mathematical problem encountered.

According to the Ministry of National Education (Depdiknas : 2006) states there are several indicators that need to be developed in learning mathematics, such as mathematical understanding, problem solving, and reasoning and communication. The ability of mathematical communication is one of the important skills in learning mathematics, such as if the communication process is well established then it can build an understanding of mathematical ideas and make it more easily understand.

Baroody (Ansari, 2009 : 4) mentions at least two important reasons why mathematical communication skills need to be developed 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 also as a valuable tool for communicating ideas clearly, precisely and closely. Second, mathematics learning as social activity; meaning, as a social activity in learning mathematics, mathematics is also a vehicle for interaction between students, as well as communication between teachers and students .

Once the importance of mathematical communication ability in mathematics, but the facts encountered with the field shows that the still low ability of students ' mathematical communication . This can be seen from the results of the PISA (Program for International Student Assessment) test held in 2009 aimed to measure the level of mathematical communication ability of students also showed the same thing . Of the 65 countries that participated in Indonesia are ranked 61, while Thailand (50), Australia (15), Kazastan (53), Japan (9), Singapore (2) and Shanghai-China (1). This data shows that the new Indonesian State can occupy the top 10 lowest of 65 countries. These results reflect how mathematical communication ability of students in Indonesia today.

This is in accordance with the fact that the results of observations at SMP Negeri 1 Labuhan Deli on October 03, 2016, mathematics learning outcomes of students SMP Negeri 1 Labuhan Deli is still relatively low because it is still below the limit of the minimum criteria of examination that apply to the school that is 75.

The low level of mathematical communication ability of students is also revealed from the research results of Asikin and Junaedi (2013: 209) illustrates that the communication ability of junior high school students is still categorized as low, the work result of the students is categorized in level (lowest level 0 and highest level IV) the system of linear equations with two variables where the scoring results by rubric scoring of mathematics communication with 160 junior high school students in Semarang City show that for the main subject Comparison: level I 78%, level II 15%, level III 5%, level IV 2%. While for the topic of Linear Equation System with two variables: level I: 67%, level II: 18%, level III: 8%, level IV: 7%.

The low of students' mathematical communication ability is caused by many factors, such as how to teach a teacher in the learning process, education orientation in Indonesia generally treats the students as an object, the teacher as the highest authority on science and subject-oriented matter. Handayani, et al (2014: 1) says teacher-centered learning, resulting in passive students in classroom learning.

This is in accordance with the results of interviews for researchers with the mother Endang who is one of the math teacher at SMP Negeri 1 Labuhan Deli on October 03, 2016 which says that teachers dominate in the learning process so that students are less active in learning, students pay less attention to teacher explanation and respond to questions teachers, it is because the teacher wants to finish the learning materials in a timely manner. Generally students are accustomed to learning activities in the form of memorizing formulas and problem-solving steps that have been done by teachers or existing in textbooks without accompanied by the development of mathematical communication ability. As a result passive students in learning in the classroom. Furthermore, the learning model used by the teacher is less varied and interesting, causing the students less interested in receiving the material submitted by the teacher. Or in other words has not applied active and interesting learning such as problem based learning, realistic mathematics education, and inquiri learning.

Problem Based Learning (PBL) is one of the learner-centered learning by confronting learners with the various problems faced in their life. In other words the problem-based learning model is a learning model that challenges students to "learn how to learn", work in groups to find solutions to real-world problems. This is in line with the opinion of Arends (2008: 45) that "PBL involves students to interpret and explain real world phenomena and to construct their own understanding of the phenomenon." This gave problem is used to bind students to the curiosity of the intended learning. The PBL curriculum facilitates the successful problem-solving, communication, group work and interpersonal skills better than other Education, in line with Amir (2013: 49) "that with the PBL conducted in the learning group getting more ability that is problem-solving skills, critical thinking ability, team work ability, interpersonal ability and communication and information search and information processing ability.

The advantages of problem-based learning model (Trianto, 2009: 96) are: realistic with student life, concepts according to the needs of students, Fostering the nature of student inquiry, concept retention becomes strong; and fosters problem solving abilities. Furthermore, the three components that play a central role in problem-based learning in the form of teaching materials, class interactions and teacher interventions so that in the learning activities there is a focus on attention to students. Thus in teacher-based learning does not present the concept of mathematics in the finished form, but through problem-solving activities students are led to find the concept of knowledge itself.

Realistic mathematics education is a mathematics learning based on view that mathematics is a human activist (Gravemeijer, 1994). Realistic mathematics education is learning that goes from 'real' things to students, emphasizes skills, discusses and collaborates, argues with classmates so that they can find their own and ultimately use that math to solve problems both individually and in groups. In this lesson the role of the teacher is nothing more than a facilitator, moderator or evaluator while students think, communicate ideas, train the nuances of democracy by respecting the opinions of others.

In general, the theory of realistic mathematics education by Gravemeijer (1994: 114-115) consists of five characteristics: (1) phenomenological exploration; (2) bridging with vertical instruments; (3) student contributions; (4) interactivity; and (5) linkages. The essence of this characteristic of realistic mathematics education basically emphasizes that the learning of mathematics starts from realistic problem. Thus, this characteristic corresponds to the expected learning in the SMP / MTs mathematics curriculum (BSNP, 2006: 139): "In every opportunity, mathematical learning should begin with the introduction of contextual problems. By posing contextual problems, learners are gradually guided to master the mathematical concept ". By using realistic mathematics education that links real-world problems or problems imaginable by students with learning materials so that learning becomes meaningful and fun for students. This will improve students' mathematical communication ability.

Inquiri learning is a learning activity that involves maximally the entire ability of students to search and investigate something systematically, critically, logically and analytically so that they can formulate their own findings with confidence. In this lesson idea or ideas are conveyed through the process of discovery. This is in line with the opinion of Bruner (Budiningsih 2005: 41) who says that the learning process will work well and creatively if the teacher gives the learner the opportunity to find a concept, theory, rule, or understanding

through the examples he encounters with his life . Inquisition of instructional materials is not presented in the final form, learners are required to undertake various activities to collect information, compare, categorize, manganalisi, integrate, organize materials and make conclusions.

Suherman, et al (2003: 190) states that the activities of discovery nuance opportunity to improve the ability in learning mathematics. In line with Kemendikbud (2013: 199) that the advantage of using inquiry model is to make students active in issuing ideas and can help students to acquire the concept of learning so that indirectly can improve student self-confidence. Thus, inquiry learning is able to cultivate students' mathematical communication ability with the involvement in students learning actively and creatively in the learning process and able to encourage students to get a better understanding of mathematical concepts or principles. Students and teachers are equally active in issuing ideas, even teachers can act as students, and as researchers in discussion situations. So students can think, work on their own initiative, and student communication can be trained.

In the matter of linear equations one variable of things emphasized on learning is that students should be able to portray situations, drawing, using objects, understanding concepts, procedures and skills to model mathematics, and verbal explanations. By considering the material character of linear equations of one variable and the steps of problem based learning, realistic mathematics education, and inquiri learning above can be seen that both require students to really master the concept, active in building their own knowledge and using real-world problems as a learning context and communication ability.

In practice, the three models of student learning will be grouped to discuss with their friends of communicating mathematical ideas. Students will exchange opinions, accept and refute the arguments with their friends, arrange conjecture, to agree in making the final decision as a result of group work. In the problem-based learning model there are several learning steps that one of them develop and present the work can meet the characteristics of students' mathematical communication ability that explains the idea, completion strategy or answers obtained through writing, whether in the form of images, graphs or algebra. Then in one of the steps of realistic mathematics education to solve contextual problems also meet the characteristics of mathematical communication ability is to make mathematical models in the form of mathematical symbols of the given problem. Furthermore, in step of learning inquiry proposed hypothesis can meet the characteristics of students' mathematical communication ability that is present math questions in writing in the form of images or description of the given problem.

Based on the above explanation, that problem based learning, realistic mathematics education and inquiri learning have different learning steps. In problem-based learning the teacher guides the students to investigate the problems given in groups. In realistic mathematics education students are given problems and are required to understand and solve contextual problems independently. While in the inquiry students solve the problem given by guided discovery. But the three models are more directed to the characteristics of mathematical communication ability. So that the process of learning like this can foster students' different mathematical communication ability.

To support the research that will be done, this communication ability difference has also been investigated by previous research conducted by Susilawati (2016) shows that based on data analysis, it is obtained that there is a difference between improvement in mathematical communication ability between students using discovery learning model, problem based learning and conventional. Students using problem based learning model have the highest communication ability compared to those using discovery learning and conventional learning model. While research conducted Fadliyani (2016) showed that there are differences in the improvement in mathematical communication ability between students that were given PBL with guided discovery. This is evident from the results ANACOVA for F_{count} = 15,024 greater than F_{table} = 3,962. The regression equation constant for PBL is 11,450 is greater than the guided discovery of 8,826, so it can be stated that PBL is better than guided discovery in improving students' mathematical communication.

Furthermore Aziz (2015) states that there are differences in mathematical communication ability between students using inquiry learning with students using conventional learning. Moreover, Rahmawati (2013) discloses realistic mathematics education significantly better in improving students' mathematical communication ability compared with conventional learning. From some of the above research results, it is assumed that problem-based learning model is better than realistic mathematics education and inquiry learning. Based on the description of the problems that has been described previously, the authors need to examine the differences in problem-based learning model, realistic mathematics education and inquiry in improving students' mathematical ability. So this research entitled " Differences of students mathematic communication ability between problems based learning, realistic mathematical education and inquiri learning in SMP Negeri 1 Labuhan Deli."

II. Research Methods

This study aims to determine differences in students' mathematical communication ability between problem based learning, realistic mathematics education and inquiri learning in Grade VII of SMP Negeri 1 Labuhan Deli.

The population of this study were all students of SMP Negeri 1 Labuhan Deli which amounted to 937 students, consisting of 27 classes, class division is not based on achievement or rank so there is no superior class of different student characteristics. The sampling technique in this research is done by purposive sampling technique.

Based on class division, researcher takes sample of class VII-1, VII-2 and VII-6 which consist of 36 people each. Classes are taken based on agreement on the school and the researchers, it is done so as not to interfere with many activities in school and considered all classes VII is homogeneous means its ability is relatively the same, it can be seen from the results of daily test. Data onto the form of scores obtained from the test of mathematical communication ability. Technique Data analysis is done by analysis of variance (ANAVA) One Direction.

III. Result And Discussion Of Research

MATHEMATICAL COMMUNICATION SKILLS

To get a picture of differences in students' mathematical communication ability between problem-based learning, realistic mathematics education and inquiry learning descriptively by looking at differences in average mathematical communication ability of each student indicator. The calculation results can be seen in the following table:

Table 1. Mean Average Mathematical Communication Capability of Each Indicator

Indicator	Problem Based Learning	Realistic Mathematics Education	Inquiri Learning
	Post test	*Post test*	*Post test*
Indicator 1	3.23	3.07	3.18
Indicator 2	3.07	2.85	2.92
Indicator 3	3.10	2.91	2.99

Based on Table 1 above can be seen that the average score of post test of each indicator of learning clearly visible difference. This indicates that the students' ability in each class after being given treatment is different. In problem-based learning the indicators present a written mathematical statement of the form of pictures or descriptions of the given contextual problems obtained a higher average score of 3.23 compared to realistic mathematics education that is 3.07 and inquiry learning is 3.18. While the indicator to make mathematical model in the form of mathematical symbol, to determine strategy and solve problem of average score of problem based learning is higher that is 3.07 compared to realistic mathematics education that is 2.85 and inquiry learning is 2.92. And on the indicator explain the idea, the strategy of completion or answer obtained by the average score of learning-based problem is higher that is 3.10 compared with realistic mathematics education that is 2.91 and inquiry learning is 2.99. It is clear that students' mathematical communication abilities in the three classes are different. Compared to the above table the average score of communication skills in problem-based learning are higher than using realistic mathematics education and inquiry learning. The difference in mean scores is due to the different learning processes of PBL and RME and inquiry learning. In problem-based learning, students begin learning with the problems provided by teachers through the LAS. Where the problem is a contextual problem, teachers who use context problems and act as organizers. From the problem given, the students solve the problem and find the mathematical concepts related to the material being studied.

Significant difference tests by using ANOVA One Direction statistical test, before used ANAVA One Direction statistic must meet normality test, homogeneity test.

Normality tests

The normality test of the post test score of the students' mathematical communication ability tests of the experimental class 1, the experimental class 2 and the experimental class 3 aims to find out whether the sample data obtained comes from normally distributed populations. The result of normality tests for students' mathematical communication ability in all three classes was analyzed using Kolmogorov Smirnov test with the help of SPSS 17 presented in Table 2 below:

Table. 2 Test Results Normality Test Mathematical Communication Ability in All Three Classes

Tests of Normality

	Kelas	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Posttest	Problem-Based Learning	.191	33	.003	.937	33	.056
	Realistic Mathematics Education	.124	33	.200*	.957	33	.210
	Inquiry Learning	.116	35	.200*	.952	35	.130

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Based on Table 2 above shows that significant pre test of mathematical communication ability of problem based learning is 0.056, realistic mathematics education 2 is 0.210 and inquiry learning is 0.130 where 0.056> 0.05, 0.210>: 0.05 and 0.130>: 0.05. So H_0 received H_a rejected. Thus the post test data onto mathematical communication ability is normally distributed.

Homogeneity Test

Testing homogeneity of post test scores of students' mathematical communication ability tests for problem based learning, realistic mathematics education and inquiry study aimed to find out whether the sample data obtained came from homogeneously distributed populations or not. The homogeneity test result of students' mathematical communication ability in the three classes was analyzed using Barleet test with the help of SPSS 17 presented in Table 3 below:

Table. 3 Homogeneity Test Results Mathematical Communication Ability in All Three Classes

Test of Homogeneity of Variances

Posttest

Levene Statistic	df1	df2	Sig.
1.809	2	98	.169

Based on Table 3 above shows that significant post test result of students' mathematical communication ability in both experimental class is 0169, so having Sig value> 0.05, then H0 received Ha rejected. Thus the variance between post test score of students' mathematical communication ability on problem based learning, realistic mathematics education and inquiry learning come from populations having equal variance.

Hypothesis testing that has been formulated used one-way variance analysis using statistic F with the formula and criteria set. The results of hypothesis test analysis analysis with the help of SPSS 17. can be seen in Table 4 below:

Table 4. One-way Variance Analysis for Mathematical Communication Ability

ANOVA

Posttest					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	399.370	2	199.685	3.259	.043
Within Groups	6004.868	98	61.274		
Total	6404.238	100			

Based on the results of variance analysis for the model obtained Fcount = 3.259> Ftable = 3.08 and with sig = 0.000. Because the sig level is smaller than 0.05, so Ho is rejected and Ha accepted. it can be concluded there are differences in mathematical communication ability between students that are given problem-based learning with realistic mathematics education and inquiry learning. For the ability of mathematical communication obtained significant value of pre test is smaller 0.05, it can be concluded that from 95% confidence level, the result of mathematical communication ability is influenced by the pre test of the students before the problem based learning, realistic mathematics education and inquiry learning. It can be concluded that there is a difference in the improvement in mathematical communication ability between students that are given problem based learning with students that are given realistic mathematics education, and inquiry learning on PLSV material.

ANSWER PROCESS

Student response process is seen based on indicators of each mathematical communication ability. Here are examples of student processes and errors based on indicators of mathematical communication ability for each class:

a. Presents a written mathematical statement of the form of an image or description of a given contextual problem

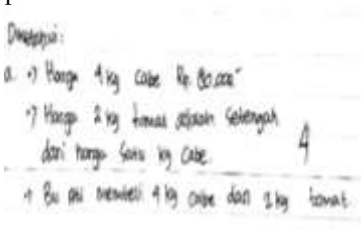

Figure 1 The process of student answers to the PBL Class

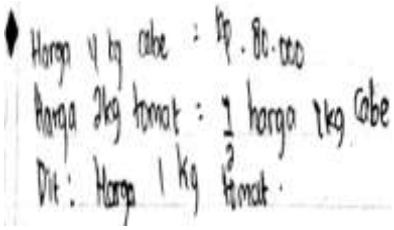

Figure 2 The process of student answers on the RME Class

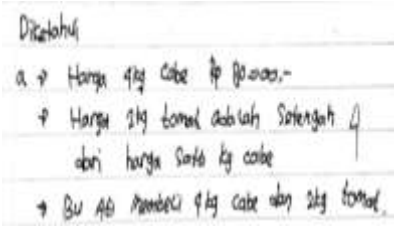

Figure 2 The process of student answers on the Inquiri Class

b. Creating mathematical models of mathematical symbols, defining strategies and solving problems

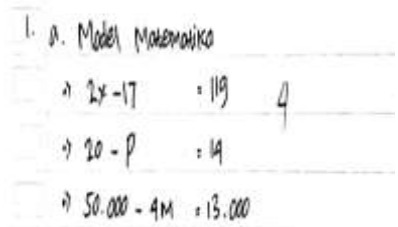

Figure 4 The process of student answers to the PBL Class

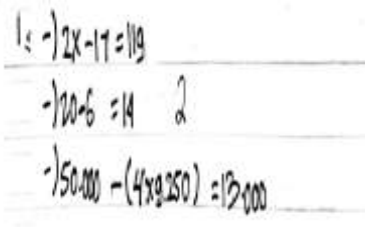

Figure 5 The process of student answers on the RME Class

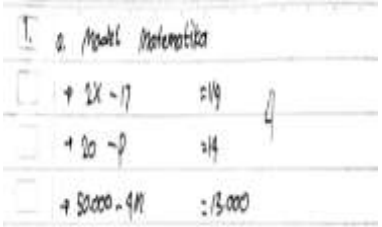

Figure 6 The process of student answers on the Inquiri Class

c. Explain ideas, completion strategies or answers obtained.

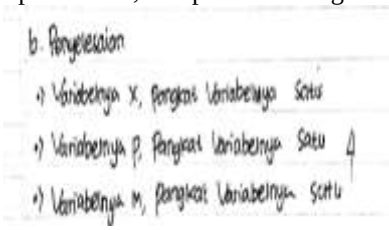

Figure 7 The process of student answers to the PBL Class

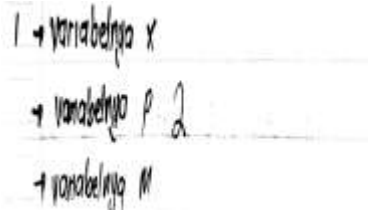

Figure 8 The process of student answers on the RME Class

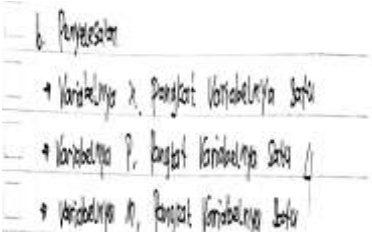

Figure 9 The process of student answers on the Inquiri Class

Based on the results of the student's answer process analysis found that, the process of student answers on problem-based learning more to get "good" assessment criteria. The process of student answers to problem-based learning is structured, systematic as well as in accordance with indicators of mathematical communication ability when compared with the student's answer process in realistic mathematics education and inquiry learning.

IV. Conclusion

Based on the results of data analysis and research findings during problem based learning, realistic mathematics education and inquiry learning with emphasis on students' mathematical communication ability, obtained some conclusions which are answers to the questions about the formulation of the problem. The conclusions are as follows:

1. There is a difference in mathematical communication ability between students that are given problem-based learning with students who are given realistic mathematics education and students that are given inquiry learning. 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 contextual problem given that is 3.23, the indicator makes mathematical model in the form of mathematical symbol, determine the strategy and solve the problem that is 3.07, indicator explaining the idea, strategy of

completion or answer obtained that is 3.10. While for experimental group of realistic mathematics education in indicator present statement of mathematics in writing which in the form of picture or description from contextual problem given that is 3.15, indicator make mathematical model in the form of math symbol, determine strategy and solve problem that is 2.95, indicator explain idea, strategy completion or answer obtained is 3.05. And for the experimental group of inquiry experiments on the indicator presents a written mathematical statement in the form of picture or description of the given contextual problem is 3.19, the indicator makes mathematical model in the form of mathematical symbol, determines the strategy and solve the problem that is 2.97, indicator indicator explain the idea, in the answer is 3.04. In this case, the average mathematical communication ability using problem-based learning is better than realistic mathematics education and inquiry learning.

2. The process of completion of student answers in solving problems of mathematical communication ability on problem-based learning is better than the student's answer to realistic mathematics education and inquiry learning, and the level of student's answer errors in solving problems of mathematical communication ability in problem-based learning is less than level of student's error in realistic mathematics education and inquiry learning. This can be seen from the work of students on problem-based learning, realistic mathematics education and inquiry learning.

V. Suggestion

Based on the result of research, problem-based learning of realistic mathematics education and inquiry learning applied to the learning activity give important things for improvement, for that the researcher suggest the following things:

1. In problem-based learning, realistic mathematics education, and inquiring learning the role of teachers are as a facilitator in the learning process, so teachers should be able to create a fun learning environment for students, giving students the opportunity to generate ideas or ideas in their own way , students should also be given the opportunity to assess their peers' answers so that in learning the students become more courageous to share the right reasons for something, more confident and creative in communicating the discovery of the answer to a problem.
2. For other researchers that use problem-based learning realistic mathematics education and inquiry learning to be able to improve other mathematical ability such as problem solving, mathematical reasoning, mathematical connections, mathematical representation and so on.
3. In this study compared is problem-based learning, realistic mathematics education and inquiry learning. The researcher suggests to the reader or subsequent researcher to be able to conduct similar research, ie comparing the more equivalent learning model, for example the problem-based learning model compared to the modified problem-based learning model, such as ICT-based.

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