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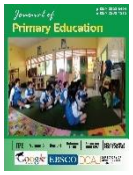

Analysis of Reasoning Ability and Mathematical Communication Based on Learning Styles on PMRI Learning

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Abstract

This study aims to determine the mastery of reasoning ability and mathematical communication, the difference of reasoning ability and mathematical communication in the two sample classes, and also describes the students' reasoning and communication ability. Type of research used is mix method. Quantitative research with random sampling technique while qualitative research with purposive technique. Data collection uses observation, tests, questionnaires, and interviews. The learning mastery test shows that the reasoning ability and the mathematical communication of the experimental class learners reaches completeness. The average difference test shows that the reasoning ability and the experimental mathematics of the experimental class is better than the control class. Based on the learning style not all students who have good reasoning ability, the communication skills are good, and vice versa. This research is expected to be useful to be a source of information in answering the problems that occur in the learning process, especially in improving student learning outcomes in sub rectangular themes.

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INTRODUCTION

Mathematical subject and reasoning are two inseparable matters. Mathematical material is understood through reasoning, and reasoning is understood and trained through learning mathematical material. Students can think and reason a mathematical problem if they have been able to understand the mathematical problem (Bani, 2011). The reasoning activity must be done by the students, if they do not do the thinking activity while studying then what they gain is just rote and do not understand the core or the concept of the material that has been studied (Amir, 2014). Mathematics as a tool of human communication because mathematics is a series of languages that symbolize the meaning of the statement to be conveyed. This logical and systematic mathematical language prevents the ambiguity of interpreting the information conveyed, either in concept or definition (Arifin et al., 2014).

A study by Brenner (1998) entitled "Development of mathematical comunication in problem solving. Group by language minority students" suggests that learning in algebra classes lacks mathematical communication skills, most of which are still oriented towards simple answers. Similar opinion also suggested by Prayitno et al., (2013) and Gunawan (2014), shows that the mathematical communication skills of Indonesian students are still ranked low. Furhtermore, Putri et al (2017) and Rahayu et al., (2014) also said that students' mathematical ability is still lacking, one of which is not true in expressing mathematical idea, using symbols, translating problem into math language. Whereas through communication allows mathematical thinking to be observed and therefore communication facilitates the development of thinking.

According to preliminary results with the principal of SMP N 4 Purwanegara revealed if there are still some learners who get grades below the value of learning mastery, students' mathematical communication skills have not developed optimally. Most students have difficulty in writing, explaining, and presenting their mathematical ideas. While Mahmudi (2009) argues that a good communication process has the potential to trigger students to develop ideas and build mathematical knowledge. According to Yuliardi and Casnan (2017), empirical evidence in the field shows there are still many junior high school students who do not understand the concepts of geometry. Therefore, it is desirable for the teachers to provide questions of reasoning or non-routine questions and train students to solve problems with a deep understanding of mathematical concepts. In addition, the need for the development of students' communication skills

One of the strategies in teaching is to know the learning style of the students. According to Moussa (2014) learning styles have been shown to play an important role in the learning process. By knowing the learning styles of each student is expected to improve the learning process. Meanwhile, according to De Porter & Hernacki (2015) learning styles are divided into three categories: visual, auditorial and kinesthetic learning styles.

According to Widodo (2014) and Riyanto et al., (2014) mathematics learning by using PMRI approach is effective. This is similar to Syaban's opinion in Octaviani et al., 2015) that in learning mathematics should be developed such as critical, careful, objective, open attitude, curiosity, and enjoy learning math. Therefore, PMRI learning can be used to achieve mastery of students' reasoning and mathematical communication skills and also to improve the students' reasoning and communication skills. This research is expected to be useful to be a source of information in answering the problem of increasing the ability of reasoning and mathematical communication that occurs in the learning process and can develop the quality of learning to be better and interesting.

METHODS

This research is a mixed method research, which is a combination of quantitative and qualitative methods to be used jointly in a research activity, to obtain more comprehensive,

valid, reliable and objective data (Sugiyono, 2014). Design in this research sequential explanatory, the first stage is done by quantitative was used method followed by collecting and analyzing qualitative data. Second stage which is built based on initial quantitative result. Quantitative methods are used to answer the mastery of reasoning abilities and mathematical communication while qualitative research to answer how students' reasoning and communication skills based on learning styles.

The population in quantitative research is the students of class VII of SMP Negeri 4 Purwanegara academic year 2016/2017 with sampling using random sampling technique, that is class VII A as experiment class and class VII B as control class. While in qualitative research, research subject is chosen by purposive technique, that is chosen with certain consideration and purpose. Research subjects were chosen based on the students' reasoning and communication skills test scores. In the qualitative research were selected 6 subjects, each of 2 subjects from upper, middle and lower category students.

Data on quantitative research is obtained by observation and test methods. Whereas qualitative research data is obtained from questionnaires and interviews.To obtain the data of the student's name and the initial value of the student to be studied. The test is used to obtain data about reasoning and communication abilities students on rectangular materials. To explore students 'reasoning and communication skills based on students' test results using interview methods. Questionnaires are used to find data of student learning process.

The students' reasoning and communication skills test was used 7 question in essay form with characteristics of reasoning ability are (1) perform analysis of the relationship between concepts; (2) perform calculations using formulas; (3) conclusions; (4) compile the proof. While the characteristics of students' mathematical communication skills are (1) expressing mathematical ideas in a problem into visual form, drawing, diagram, table/graph; (2) state the problem in the language or symbol of mathematics; (3) write mathematical sentences according to problem in question; and (4) write procedure/settlement algorithm.

RESULTS AND DISCUSSION

Stage One (Quantitative)

Complete Test of Reasoning Ability and Mathematical Communication

In quantitative research, before performing the hypothesis test firstly done normality test to determine whether the data used normal distributed. Then normal distribution of data can be tested hypothesis. Uji mastery of learning outcomes by class using a proportion test of one party. Testing test is used to determine whether the classes taught to use educational PMRI-based educational courses complete if at least 75% of students achieve the value of the established KKM is 65. the completeness test is done based on the value of reasoning ability tests and students' mathematical communication skills that contains seven items of the description. With a real level of α = 0.05 from the standard normal table gives the value Z_{table}= 0.4744. Value Z_{count}= 1.95 greater than Z_{table} = 0.4744 this means H_o *is* rejected. In other words H_1 is accepted and its means the student has completed his studied more than 75%. So the educational PMRI-based learning game reaches the minimum mastery criteria.

Test The Differences in Reasoning Ability and Mathematical Communication in The Experimental and Control Groups

Different tests were used to determine the difference in average reasoning ability and mathematical communication skills between students taught using educational PMRI-based instructional learning (experimental class) and students' mathematical reasoning and communication skills that were taught by expository learning (control class) on a square flat area.

Table 1. Average Difference Test of Experiment Class and Control Class

Test of variance variances			Test the average similarity			
F_{hitung}	Sig.	Keterangan	t_{hitung}	Df	Sig	Keterangan
0,016	0,900	H_0 diterima	2,869	48	0,006	H_0 ditolak

Based on Table 1, Shows that the equality test has a F_{value} = 0,016 with significance value 0,900 > 0,05, which means that H_0 stating that the variance of both groups is not different or accepted. From this conclusion then to test the equality of the average ability of the two groups then used t test with the type of equal variances assumed. From the test results obtained t_{value} = 2.869 with a significance value of 0.006 < 0.05 which means that H_a which states there are differences in the average ability of both groups received. From the results of this analysis can be concluded that the learning achievement of experimental group is different from the learning achievement of the control class.

Phase Two (Qualitative)

The results of research in the second stage in the form of qualitative focused to follow up the results of research in the first stage of deeper review related aspects of reasoning ability and mathematical communication students experimental class. The data used is based on quantitative data that has been obtained in the first stage. Based on the value of students' reasoning and communication skills test, the experimental class is divided into three categories: upper group category, middle group, and lower group. Each category was taken two people who serve as the subject of research. Research subject taking by looking at the value of reasoning and mathematical communication test, for the upper group, two subjects with two upper grades were taken. The middle group was taken two subjects who had the value of ability test reasoning and mathematical communication are in the middle between the upper and lower groups. The lower group is drawn from two subjects who have a value of reasoning ability and the lowest two mathematical communication from below. How to take is intended to maximize differences in reasoning ability and mathematical communication owned by the subject of research. Interview techniques are used to confirm the results of answers from students' reasoning and communication skills tests.

Qualitative research results obtained from the analysis of student work results and in-depth interviews of six students of choice from each category showed that most students have been able to do the relationship between concepts, perform calculations using formulas, generalize or conclusions and also do the proof. Interview results also explain that the applied learning model is not boring, so students are more active to learn and construct their own knowledge, work in groups and motivated to solve every challenge they encounter in learning.

According to students accustomed to working on projects and exercises about them to be more understanding of the concept when dealing with difficult problems, feel challenged and enthusiasm when dealing with the problems given in a healthy atmosphere of competition. This shows that students' ability to solve problems related to inter-related topics in mathematics, mathematics and other disciplines, and mathematics with everyday life increases with the learning fun for students.

From interviews and questionnaires as well as observations of researchers during the learning process students' reasoning and communication skills are also influenced by learning styles. According to Moussa (2014), learning styles have been shown to play an important role in the learning process. Learning style is one of the important factors and concerns how students understand certain lessons (Rofiqoh et al., 2016). This is because everyone has his own learning style that determines how he interacts with his learning environment. There are students who have reasoning ability and communication skills with high, medium and low criteria.This is because a person's ability to understand and absorb the lesson is definitely different levels. Therefore, students often have different way to understand the same information or lessons. Based on in-depth interviews and observations during the study found that not all students who have high reasoning ability communications

good skills.Vice versa there are some students who have good communication skills but reasoning ability is still lacking. Researchers can conclude why it can happen because it is influenced by the learning style of the student. Student result test for student code E-20 can be shown in Figure 1.

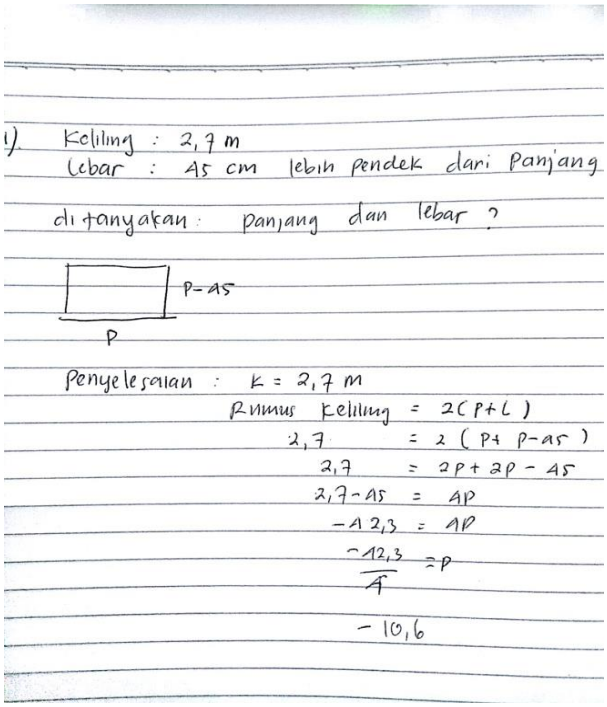

Figure 1. Results of The A Theories of Reasoning and Communication Student Code E-20

Base on Figure 1, can be analysed that te mathematical communication ability of the students as follows, he is able to express the mathematical idea in a problem into the form of picture (indicator 1), he also able to express the problem in the form of language or symbol of mathematics (indicator 2) write the mathematical sentence (indicator 3) and write the procedure completion coherently and clearly (indicator 4). It corresponds to Anintya (2017) that the ability of students' mathematical communication with visual learning style can be categorized in the level of achievement 4. Whereas if viewed from the ability of reasoning students can already analyze the relationship between concepts (indicator 1). Write the formulas used correctly only in doing calculations using the formula (indicator 3) is less thorough so that the end result is wrong. Therefore we can conclude students who have good communication skills not necessarily good reasoning ability.

Based on the observation of the student's answer if we see from the learning style of students is classified as students with visual learning style, he used to see something neat and meticulous, usually by writing things that he considered important, during the learning process he likes to doodle using own language. This is in accordance with De Porter & Hernacki (2015) that someone with a visual learning style will usually be more thorough and detailed. Such as students with good reasoning level is not necessarily the ability communication is good. Look Figure 2 student test results with the following E-17 code.

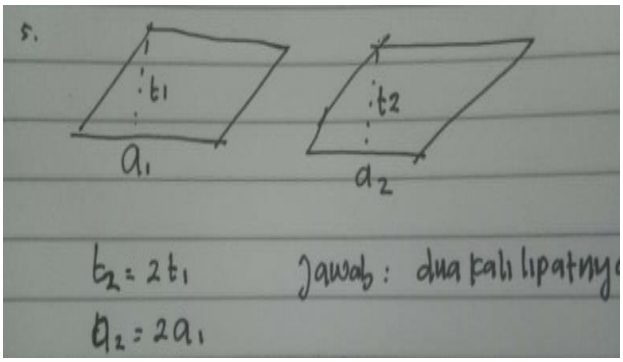

Figure 2. Results of The Reasoning and Communication Reasoning Test Student Code E-17

From the work of E-17 we can analyze the students' reasoning ability as follows, he can do the relationship between the concepts (indicator 1). Students conclude that the second parallelogram is the first time the first parallelogram. And the student's answer is correct in accordance with his mindset based on the data on the problem (indicator 2 and 4). While his communication skills can be seen as follows, students are able to express the idea of mathematics into the form of images (indicator 1). Only the settlement procedure has not been write in a coherent and clear. This shows that students with good reasoning ability is not necessarily the ability of communication is also good.

Students with good reasoning ability tend to be students with auditorial learning styles. He used to learn by listening, when the teacher is explaining he recorded his knowledge in the brain, sometimes students with this learning style is lazy to write and can be said students with this learning style do not even have a note, therefore his communication skills can say in less. This is consistent with Tiffani (2015) that students with auditorial learning styles have not been able to recall information during the planning and execution process of completion. In previous research was conducted by Anintya et al., (2017) only explains communication skills based on learning styles while this study explains that based on learning styles not all students who have good communication skills good reasoning ability. Therefore this research is expected to be useful to be a source of information in answering the problems that occur in the learning process and can develop the quality of learning to be better and interesting especially in the learning sub chapter rectangle in junior high school students.

CONCLUSION

The conclusions of the results of this study are (1) The ability of reasoning and communication of mathematics students to achieve mastery, (2) The ability of reasoning and communication of mathematics students in the class taught using PMRI learning is higher than the classes taught by using expository learning, (3) overall the average reasoning and mathematical communication skills of students based on the indicators used are in either category. This can be shown from the thoroughness of the students' reasoning and mathematical communication test that has reached the minimum KKM completeness that is equal to 65, and (4) Not all students with good reasoning ability, the communication ability is also good. There are students who have good reasoning ability but communication skills are lacking, so there are students who have less reasoning ability but good communication skill. This is because of the different learning styles of students. Based on the results of student research students who good reasoning tend to students with Auditorial learning style. He is accustomed to learning by listening, students with this style feel lazy to write but clever in speaking so that his communication skills are less written. Vice versa students who have good communication skills are identical to the Visual learning style. He was accustomed to seeing things neatly and thoroughly, happy to write down something he considered important in his own language, he knew what was meant but was not good at picking up words to say.

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