The Analysis of Students'Mathematical Problem Solving Ability on Quadrilateral Material in VII Grade Student Muhammadiyah 57 Medan Junior High School

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ABSTRACT

This research aims to determine students' problem solving ability in solving Quadrilateral material. This study is a descriptive qualitative research. Instruments tend to be used in this research were tests and interviews. Subjects in this research is students of class VII-2 junior high school Muhammadiyah 57 Medan totaling 30 students. The results of data analysis stating that there are only 6 students (20,00%) is achieve the criteria of problem solving ability, while there are still 24 students (80,00%) is not achieve the criteria of problem solving ability. Based on the percentage of achievement indicators of problem solving ability, overall students were only able to achieve the indicator 'understanding the problem' with at 70.67%, while the indicator 'devising a plan' only at 41.33%, indicator 'carrying out the plan' at 65.33%, and the indicators 'looking back the problem solving' at 40.67%. Based on the analysis of students' answer sheet and interviews which has been conducted, student's mathematical problem solving ability of class VII-2 junior high school Muhammadiyah 57 Medan is still low.

Keywords: *Mathematical Problem Solving Ability*
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1. INTRODUCTION

Education is the means and the right tools in shaping the desired society and nation, the cultured community, intelligent, and capable to compete in the advancement of science and technology. Hasratuddin (2015: 27) [1] states that "progress of science and technology demand one to be able to master the information, knowledge and various abilities. These abilities requires critical thinking, systematic, logical and creativity". One of the educational program that could develop the ability of critical thinking, logical and creative is mathematics.

In study of mathematics, the ability to think and to solve the problem is one of the very important ability that must be owned by the students. The ability to solve problems will be a barometer for the student's success in learning mathematics. The main purpose of the students in learning mathematics are solving the problems (Kennedy, Tipps, & Johnson, 2008; Musser, Burgers, & Peterson, 2011)[2][3]. Students can also develop positive attitudes through learning to solve the problem. These attitudes are unyielding, determined and confident in unusual situations (Ontario Ministry of Education, 2006) [4]. These attitudes positively affects the ability of students in solving the problems (Pimta, Tayruakham, & Nuangchalerm 2009)[5].

Based on NCTM (2000) [6] there are 5 standard of process that must be mastered by the student through the study of mathematics, there are: i) solving the problem, ii) reasoning and proving, iii) connection, iv) communication, and v) representation. Mathematical problem solving abilities is a primary goal in mathematics. Branca (1980) [7] states

that: "The ability to solve problems are a common objectives in the teaching of mathematics and the heart of mathematical ". Problem solving abilities very important to be owned by the students. Based on NCTM (2010: 1) [6] solving the problem is an important component for the students to possibly gain experience using the knowledge and abilitys already owned to applied at solve the problem. Hudojo (2005: 133) [8] said that "solving the problem is something that is essential in the study of mathematics at the school, because students become abilityed at selecting relevant information, analyze it and then examine the results". Furthermore Branca (1980) [7] suggests "the importance of problem solving ability mathematics, because: i) problem solving ability is the purpose of learning mathematics, ii) problem solving contain by the method, procedure, and strategy and play proccess in mathematics curriculum, iii) problem solving ability is base in learning mathematics".

In the process of problem solving on students, an outline of the problem solving process is divided into two kinds, there are representation and solutions. Representations appeared to understanding the problem, and solutions appeared when conducting an activity to solve the problem (Stenberg and Ben-Zeev, 1996) [9]. Before solving the problem, understanding the problem is the aspect that had to owned by the students. According Hasratuddin (2015: 72) [1] that "the ability to understand the problem can be nurtured by giving problems related to student experience'. Therefore, in this study will be focused to see the students' ability in solving mathematical problems that are contextual.

This study was conducted to determine the level of problem solving abilities of the students in solving problem on the material Quadrilateral. In General, this study aims to determine the mathematical problem solving abilities of students to solve problems of mathematical descriptions in the form of contextual word problems. In particular, this study aims to determine: (1) The mathematical problem solving abilities of the students in the process of solving problems on Quadrilateral material, and (2) the responses of the students in solving problem on Quadrilateral material.

2. PROBLEM SOLVING ABILITY

Generally in mathematics learning activity, problem solving is the ability or abilitys of the students in applying knowledge previously learned into a unknown situation to completing the test questions, using problem solving steps. The problems is different with a routinity question. The problem is a question that is not routine, challenging, but still may be resolved by the way of settlement that are not immediately found by the students (Posamentier and Krulik, 2009) [10]. Not routine because the answer can not be as simple as substituting the values to a a certain formulas as student usually did. Ruseffendi (2006) [11] states that "a question is a problem for the students if the question was not known or the student has not had a specific algorithm to solve it". The problem that was given to students, should problem that close to his daily life.

As Wahyudin (2008: 27) [12] said that "solving problems means participate to complete a task which method unknown before. Basicly Problem solving is to learn to use scientific methods or to think in a systematic, logical, orderly and careful". In addition, problem-solving is also a very important activity in mathematics, because the objectives of learn it is to be used in the solution of problems related to everyday life. Problem solving is the important part for Mathematics, because in the learning process the students are able to use the knowlegde which they have before to solving the problem. Uno (2009:134)[13] State "Solving the problem as one of many way for student to utilize their mind to solved the problem by gathering the fact, analyze the information, sorting out various way of solution, and selecting the most effective way to solve the problem". Solving the problem means finding a way out of trouble and get the correct final result by correct procces.

Saragih and Habeahan (2014) [14] states "Problem solving ability is a process for accepting the challenge of answering the finishing non routine math problem in the contextual form or story questions". According to Polya (1985) [15] on solving the problem there are 4 steps that must be done, there are: "first, we have to understand the problem; we have to see clearly what is required. Second, we have to see how the various items are connected, how the unknown is linked to the data, in order to obtain the idea of the solution, to make a plan. Third, we carry out our plan. Fourth, we look back at the completed solution, we review and discuss it". In simple way Polya (1985) [15] state that solving proble indicator are 4 steps, There are: i) understanding the problem, ii) devising a plan, iii) carrying out the plan, and iv) Looking back the problem solving. In this study, the four problem solving abilities indicators stated by Polya, will be used as a guide in measuring the students' mathematical problem solving abilities.

The activities that the student able to do in each Problem Solving Abilities in each indicator cab bel seen from Table 1 below :

Table 1. Students Activities In Each Indicators of Problem Solving Abilities

No	Indicator	Students Activities
1	Understanding the problem	Write down anything known and asked on the problem also write down every available information.
2	Devising a plan	Write down the solution plan based on anything known and asked on problem.
3	Carrying out the plan	Write down the solution problem based on the plan.
4	Looking back the problem solving	Recheck the solution by testing the result and makin sure that the step are correct and whole.

3. RESEARCH METHOD

This type of study is descriptive qualitative. The qualitative descriptive study which included on qualitative study type. Moleong (2014) [16] said that "a qualitative study which using a naturalistic approach to search and find the sense or understanding of phenomena in the context of the particular background. Furthermore Sugiyono (2015: 15) [17] said that "qualitative study is a study method that is used to studying the condition of natural objects, analyze the information which is inductive and qualitative study results for a further emphasize onthe significance of the generalization". Descriptive approach it self mean this study seeks to expose the facts, phenomena, and circumstances that occur as the study proceeds as it is based on information obtained.

The research was conducted in junior high school Muhammadiyah 57 Medan. Subjects in this study were students of class VII-2 consisting of 30 students.The information gather method used in this study are test and interview. The tests given are the form of problem solving ability test that has been validated by 3 experts. Furthermore, the interviews were unstructured, because the interview was conducted after getting the results of tests given, and is focused to find out the errors of students in solving the problem. The lattice of test instruments used in the study can be seen by Table 2 below:

Tabel 2. The Lattice of Mathematics Problem Solving Ability Test

Indicator	Aspect That is Measured	Number of Item
Understanding the problem	- Write down that has been known and asked. - Write less or more anything that has been known to solve the problem.	1a
Devising a plan	- Write down the plan to solve the problem	1b
Carrying out the plan	- Doing careful calculation based on the plan that has been wrote.	1c
Looking back the problem solving	Doing one of these: - Rechect the solution (retest the result), - Write down a reason that the result is correct.	1d

To identify the Mathematics problem solving indicator on solving the mathematics question on contextual problem in rectragular material, the information will be analyze with accurate. Analysis of mathematics problem solving abilities indicator achievement can be seen on table 3 below:

Tabel 3. Guidelines Score of Mathematical Problem Solving Ability

Aspect	Indicator and Criteria	Score
	Understanding the Problem	
Make known and asked	Write down anything known and asked correctly and whole.	3
	Write down anything known and asked correctly but not whole.	2
	Write down anything known and asked uncorrectly.	1
	Do not write down the things that are known and asked.	0

Aspect	Indicator and Criteria	Score
Explain the reason adequacy of the data	Write down with right reason.	2
	Write down with enough reason.	1
	Do not write down the reason.	0
Devising a Plan		
Devising the solution plan	Write down the solution plan correctly and whole.	5
	Write down the solution plan correctly but not whole.	3
	Write down the solution plan uncorrectly.	1
	Do not write down the solution plan.	0
Carrying Out the Plan		
Create of solving problem	Write down the solution with correct and whole result.	5
	Write down the solution with correct but not whole result.	4
	Write down the solution almost correct and whole result.	3
	Write down the solution with uncorrect and whole result.	2
	Write down the solution with uncorrect and not whole result.	1
	Do not write down the solution.	0
Looking Back the Problem Solving		
Recheck the Solution	Write down the recheck solution with correct and whole result.	5
	Write down the recheck solution with correct but not whole result.	3
	Write down the recheck solution uncorrectly.	1
	Do not write down the recheck solution.	0
Total Score		**20**

To determine the value of each student's problem solving abilities can be done by:

SKPM = Total Score x 5

Description:

SKPM: score problem solving abilities

The interval level of mathematical problem solving abilities of students in solving problems can be seen in Table 5 below:

Table 4. Percentage of Qualifying Student Problem Solving Ability

No	Value Interval	Category
1	$0 \leq$ SKPM < 50	Too Low
2	$50 \leq$ SKPM < 65	Low
3	$65 \leq$ SKPM < 80	Moderate
4	$80 \leq$ SKPM < 90	High
5	$90 \leq$ SKPM ≤ 100	Too High

Source: *Modified from Arikunto (2006)* [18].

In this study, the students said to have a problem solving abilities if SKPM gained ≥ 65 students with moderate category.

Furthermore, to determine the students' problem solving abilities by problem solving each indicator will be used the following formula:

$$KI_i = \frac{total\ score\ of\ students\ in\ each\ indicator}{\max imal\ score} \times 100\%$$

Source: *Adaptation of Trianto (2009)* [13].

Description:

KI_i: Achievement indicators into-*i* of students problem solving abilities.

Criteria:

$0\% \leq KI_i < 65\%$ indicators of mathematical problem solving ability is not achieved.

$65\% \leq KI_i \leq 100\%$ indicators of mathematical problem solving ability is achieved.

4. RESEARCH RESULT

Information obtained based on the student's written answer sheet. Based on the results of the test mathematical problem solving abilities, the result obtained the degree of mastery of students as indicated in Table 5 below:

Table 5. Results of the test problem solving abilities in each category

No	Value Interval	Students Count	Percentage	Categori
1	0≤SKPM<50	8	26.67%	Too Low
2	50≤ SKPM <65	16	53.33%	Low
3	65≤ SKPM <80	3	10.00%	Moderate
4	80≤ SKPM <90	2	6.67%	High
5	90≤ SKPM ≤100	1	3.33%	Too High

Description: SKPM = Score of Problem Solving Abilities

According to the table above, it appears that there are 6 students (20,00%) who have problem solving abilities, with details of one student (3,33%) in the category of very high, 2 students (6,67%) in the high category, and 3 students (10,00%) in the medium category. But still there are 24 students (80.00%) who do not have problem solving abilities, with details of 16 students (53,33%) in the low category, and 8 students (10,00%) in the very low category. Based on the results, it can be concluded that the majority of students of class VII SMP Muhammadiyah 57 Medan has yet had a problem solving abilities. After looking at the overall level of student mastery, further grouping the results of the students' answers to the achievement of each indicator problem solving abilities, as listed in Table 6 below:

Table 6. Achievement Indicators Problem Solving Abilities

No	Indicator	Sample Total Score	Max Score	Percentage	Information
1	Understanding the problem	106	5 x 30 = 150	70.67%	Achieved
2	Devising a plan	62	5 x 30 = 150	41.33%	Unachieved
3	Carrying out the plan	98	5 x 30 = 150	65.33%	Achieved
4	Looking back the problem solving	61	5 x 30 = 150	40.67%	Unachieved

Based on the above table showed that the overall student in meeting the first indicator 'understanding the problems' earn achievements 70.67%, the second indicator 'devising the plan' earn achievements 41.33%, the third indicator 'carrying out the plan' earn achievements 65.33% and fourth indicator 'Looking back the problem solving' earn achievements 65.33%. Based on these results it can be said that the overall student achievement indicators only meet 'understanding the problem' and "carrying out the plan ', as has the percentage of achieving the ≥ 65%.

The process of students 'answers will be analyzed with descriptive analysis with the aim to see the students' problem solving abilities is through student answer sheets. On the answer sheet will be the student answers in meeting the indicators of problem solving abilities. Here is a given issue:

A floor with size 5m x 3m will be installed with ceramics A with size 30cm x 30cm or 50cm x ceramic B size 50cm x 50cm. If the price each pieces of ceramics A is Rp. 10.000, and ceramic B 20,000, which ceramics should be installed in order to lower costs? (A) Write the information you have from the problems. Are the data sufficient to determine the price of ceramic cheaper? (B) Write down a plan to determine the price of ceramic cheaper, (c) Determine the ceramic cheaper price based plan in part b, (d) Explain how you ensure that the correct answer.
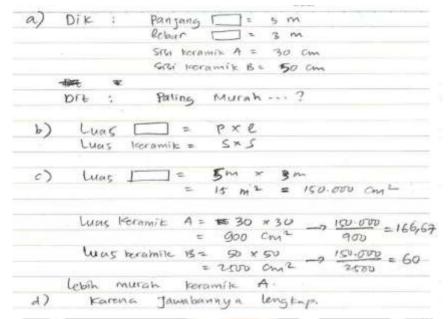
Figure 1. The student's answer sheet in problem solving ability test

Based on the student's answers sheet above that students have difficulties in the devising the plan, as seen students just write down formulas of the area of the square and rectangle. Students do not write how to determine the purchase price entirely from ceramic tile A and B, so the impact on students' difficulties in drawing conclusions to problem solving. At the stage of Looking back the problem solving, students also have not been able to check the results obtained, or explain very well that the results obtained are correct.

Interviews result showed in general the students find it difficult to solved the problems with fulfilling the overall problem solving abilities indicators. The main difficulty experienced by students is at indicator 'devising a plan' and on 'Looking back the problem solving'. Based on the description of some of the students, they are difficult to write both the problem solving stage because they are not unaccustomed to do it before. Students used to doing a routine questions which more focused on the use of the formula to get a result.

5.   DISCUSSION

The results showed the seven grade students of SMP Muhammadiyah 57 Medan yet have proper problem solving abilities. Students are said to have proper problem solving abilities if in solving the problem meet all the four phases, that understanding the problem, devise the plan, calculating, and recheck (Polya, 1985; Posamentier & Krulik, 2009) [15] [10]. However, most students have not been able to solve the problem given to fulfill all phases of the indicators of the problem solving abilities.

Based on interviews with several students, the stage of solving the problem which difficult for the students is the stage of the devise the plan and to re-examine the results of the plan that were made. Muir, Beswick, and Williamson (2008) [20] said that "at the stage of devisethe plan, good problem solvers able to implement its plans and demonstrate the ability to think metacognitive during the implementation of the plan, as well as being able to check back in the plan at the time of or after carrying out the plan". To be able to solve the problem correctly student must be at the level of the development of formal operations to be able to think abstractly. Students in class VII, generally aged 12-13 years. Piaget (Dahar, 2011) [21] said that "at 11 years old the child is at the level of formal operations, major advances in children is no need to think with the help of a concrete object because children have abilities for abstract thinking". So the class VII student should already have good problem solving abilitys.

Many factors lead to lower students' problem-solving ability. One important factor in the problem solving ability of students is metacognition. The results of various studies show that there is a positive and significant relationship between mathematical problem solving and metacognitive, ie the students gain strength metacognitive abilitys problem-solving, the more prospects for their success in solving challenging problems (Pape & Smith, 2002;

Kazemi, Fadae, and Bayat 2010) [22] [23]. Panauora, Philippou and Christou (2003) [24] believe that, "those who have a higher metacognitive abilitys, be more careful and attentive to find or understand the reality of the problem. These people will evaluate the possibility of finding an easier solution, to analyze complex problems in a way that is detailed and specific control their thought processes with the process of thinking to ask yourself ".Based on the above, it can be seen that metacognition plays an important role in the ability solution to problem. Therefore, teachers should pay attention to aspects of metacognitive abilitys in the learning activities, to maximize the students have a mathematical problem solving ability.

6. CONCLUSION

Based on the analysis and discussion of the results of research conducted when referring to the purpose of study, it can be concluded that: (1) The ability of students' mathematical problem solving and finish the given problem can only be achieved by 6 students (20.00%) out of 30 students, with details of the level of ability: 1 students in very high level, 2 students in high level and three students moderate level. While there are 24 students (80.00%) who do not have problem solving abilities, with details of the level of ability: 16 students in low level and 8 students in very low level. (2) Based on the percentage of achievement of problem-solving abilities indicators , overall students were only able to achieve anindicator 'understanding the problem' with the achievement of 70.67%, while the indicator 'devising a plan' only amounted to 41.33%, indicator 'carrying out the plan' of 65.33%, and indicators 'Looking back the problem solving' amounted to 40.67%. (3) Based on the answer sheets of students in solving the problem solving ability test, students struggle to devising a plan and Looking back the problem solving a solution of the problem. These results are consistent with the results of interviews with some students who claim that the difficulties in resolving the issue by meeting all the indicators of problem-solving ability, especially indicators of problem resolution plan and recheck.

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