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An Analysis of Students' Mathematics Problem Solving Ability in VII Grade at SMP Negeri 4 Pancurbatu

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Abstract

The aim of the study was to analyze the student's mathematics problem solving ability of class VII SMP Negeri 4 Pancurbatu on Quadrilateral. The type of the study is qualitative descriptive. The subject of the study were 31 students of class VII-1 SMP Negeri 4 Pancurbatu 2016/2017 Academic Year. The instruments of the study was Mathematics Problem Solving Ability Test. The result showed that the persentage of students' problem solving ability in first indicator of problem solving was 75,08%, the second indicator was 66,12 %, the third indicator was 29,03%, and the fourth indicator was 24,19%.

Keywords: mathematics; problem solving ability.

1. Introduction

Mathematic is a way of organising our experience of the world. It enriches our understanding and enables us to communicate and make sense of our experiences. By doing mathematics we can solve a range of practical tasks and real-life problems. We use it in many areas of our lives. Students will remember facts and skills easily when they use them to solve real problems. As well as using mathematics to solve real-life problems, students should also be taught about the different parts of mathematics, and how they fit together [1]. That is why mathematics is important.

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They are important when we need them to solve a problem. Every people in this world will always be faced with problems. According Baykul [2], the problem is a creation, in which an individual who faces it felt the need to solve or want to solve. Therefore, it is very important that we as human beings have the ability to solve the problem. Likewise with the students, each student must have a particular problem-solving abilities in solving problems or questions given by the teacher.

Pehkonen [3] has collected a set of reasons why it is important to teach problem solving. These are grouped into four categories: a) problem solving develops general cognitive skills, b) problem solving supports the development of creativity, c) problem solving is a part of mathematical application process, and d) problem solving motivates pupils to learn mathematics.

According to Kantowski [4], a situation is said to be a problem when an individual must combine (for him/her) new information in a (for him/her) new way in order to solve the problem. If the individual can immediately recognise the procedures needed, the situation is a standard task (or a routine task or exercise). The term non-standard task is often used in reference to a task that one cannot usually find in mathematics books.

The development of problem solving ability among school children has been a persistent goal of mathematics education community for over a century; however, the issue of how develop problem solving skills among learners continues to be a major dilemma. This is part, due to lack of specific knowledge about mathematical problem solving practices of children and factors that influence their choices and actions [5].

Problem solving is one of intellectual creativity type. According to Gagne [6] more higher the degree and more complex than other intellectual creativity types. Problem solving needed a complex rules and can achieve higher rules after mastering rules and define concepts. Also rules and define concept can mastering if supporting by concrete understood concepts. After that to understanding the concrete concepts need a skill and differentiated. Gagne classify the intellectual skill based on complexity levels and arrange from most simple mental operation until most complexity levels.

Therefore, with reference to the opinions of the above, then solving the problem it is important to students. This study was conducted to analyze students ability problem solving in school. Solving math problems is very important so that a general purpose teaching mathematics, even as the heart of mathematics, more priority than the process and as a result the focus of school mathematics and aims to help develop thinking mathematically.

2. Mathematic Problem Solving Ability

Problem solving is one of major aspect in mathematics curriculum which required students to apply and to integrate many mathematical concepts and skills as well as making decision. However, students were reported to have difficulties in mathematics problem solving [7].

Problem solving is a valued component in school mathematics curricula in all parts of the world, although the extent to which it exists varies from country to country [8]. Problem solving has generally been accepted as a means for advancing thinking skills. For example, in the NCTM [9] stated:

"Solving problems is not only a goal of learning mathematics but also a major means of doing so. … In everyday life and in the workplace, being a good problem solver can lead to great advantages. … Problem solving is an integral part of all mathematics learning".

Lesh and Zawojewski [10] defines "mathematical problem solving as the process of interpreting a situation mathematically, the which usually involves Several iterative cycles of expressing, testing, and revising mathematical interpretation and of sorting out, integrating, modifying, revising or refining clusters of mathematical concepts from various topics within and beyond mathematics ".

Vettleson [11] said, "in the discipline of mathematics, the use of problem solving skills has been extremely important and highly influential. Problem solving is the foundation of all mathematical and scientific discoveries ". In the disciplines of mathematics using problem solving skills have a very important influence. Problem solving is the foundation of all mathematics and the process of discovering new knowledge.

Students can learn to become better problem solvers . Polya presented four phases or areas of problem-solving, which have become the framework often recommended for teaching and assessing problem-solving skills [12] The four steps are: (1) understanding the problem, (2) devising a plan to solve the problem, (3) implementing the plan, and (4) reflecting on the problem.

Polya 1981 in [4] stated that problem-solving is a process starting from the minute students are faced with the problem until the end when the problem is solved. There are many problem solving models.

Table 1: Problem solving mode

Polya (1981)		Krulick & Rudnick (1996)		Zalina (2005)	
4 - hierarchy phase		5 - hierarchy phase		3	- hierarchy phase
i)	understanding problem;	i)	reading and thinking;	i)	Understanding problem;
ii)	planning;	ii)	analyze and planning	ii)	Solving the problem;
iii)	performing the plan;	iii)	organizing strategy;	iii)	Stating the answer.
iv)	confirmation the answer.	iv)	getting the answer;		
		v)	confirmation the answer.		

The most known mathematical problem-solving model is Pólya's model which consists of four phases: *1) Understanding the problem*, *2) Devising a plan*, *3) Carrying out the plan*, and *4) Looking back*. Other researchers have further developed Pólya's model [13].

Problem solving, as used in mathematics education literature, refers to the process where students encounter a problem – a question for which they have no immediately apparent resolution, nor an algorithm that they can directly apply to get an answer [14]. They must then read the problem carefully, analyze it for whatever information it has, and examine their own mathematical knowledge to see if they can come up with a strategy that will help them find a solution. The process forces the reorganization of existing ideas and the emergence of new ones as students work on problems with the help of a teacher who acts as a facilitator by asking questions that help students to review their knowledge and construct new connections. Nakin [15] suggests that problem-solving is a process that uses certain measures (heuristic) that help in resolving the problem.

From the opinions above, can be concluded that the mathematic problem-solving ability is ability of the student to solve problems by observing the process of finding answers based on the step-by-step problem-solving: 1) understand the problem, 2) planning, 3) performing the plan, and 4) confirmation the answer.

3. Methods

This research is a qualitative descriptive. Kothari [16] said that a qualitative descriptive research is the basic types of research that major purpose is description of the state of affairs as it exists at present. This research is a qualitative descriptive that aimed to see the pictures of student's mathematical problem solving ability. The subjects of this study were 31 students of class VII-2 in SMP Negeri 4 Pancurbatu. Problem solving ability tests in the form consisted one problem with four questions of Quadrilateral. The scoring techniques used in this study using the following guidelines:

Table 2: Grid of problem solving

Indicators of Mathematic Problem Solving Ability	Indicators of Quadrilateral	Number of Test
Understanding problem	Resolving problems related to calculate the circumference and area of a rectangle and a square	1a
Planning	Resolving problems related to calculate the circumference and area of a rectangle and square	1b
Performing the plan	Resolving problems related to calculate the circumference and area of a rectangle and a square	1c
Confirmation the answer	Resolving problems related to calculate the circumference and area of a rectangle and a square	1d

Table 3: Test scoring guidelines mathematical problem solving

Rated Aspect	Reaction To The Problem	Score
Understanding problem	Do not write data to an unknown and asked, simply, deficient / excessive write down the things that are known to solve the problem.	0
	Incomplete in writing the given data and asked, deficient / excessive write down the things that are known to solve the problem.	1
	Correct and complete in writing the given data and asked, deficient / excessive write down the things that are known to solve the problem.	2
Planning	Not writing theories / methods used to settle disputes.	0
	Not exactly in writing theories / methods used to settle disputes.	1
	Write down exactly theories / methods used to settle disputes.	2
Performing the plan	Did not make calculations.	0
	Do the calculations, but do not carry out the plans that have been made.	1
	Perform calculations with implementing the plan that has been created properly.	2
	Perform calculations with implementing plans that have been made properly and the result is not correct.	3
	Perform calculations with implementing plans that have been made properly and the result is correct.	4
Confirmation the answer	Do not do checks back.	0
	To examine the less precise.	1
	To examine the proper manner tebalik groove or enter data that is asked so that data is known to be true.	2

To calculate the persentage ot the total score for each indicator of problem solving ability (P_k) used :

$$P_k = \frac{Aqcuisition\ score\ \ on\ indicator\ to{-}k}{Total\ score\ on\ indicator\ to{-}k} \times 100\% \qquad (1)$$

$k = 1, 2, 3, 4$

With the qualification such as table 4 below:

Table 4: The qualification of total score persentage

Persentage	Qualification
$85 \leq P_k \leq 100$	Very Good
$70 \leq P_k \leq 84{,}99$	Good
$55 \leq P_k \leq 69{,}99$	Good Enough
$40 \leq P_k \leq 54{,}99$	Not Enough
$0 \leq P_k \leq 39{,}99$	Very Less

Arikunto [17].

4. Results and Discussions

4.1. Results

From the research data showed the test results of mathematical problem solving ability of students are presented in table 5 as follows:

Table 5: Students' score of indicators of problem solving ability

Code of Student	Score of Indicators			
	Understanding problems	Planning	Performing the plan	Confirmation the answer
S1	2	2	4	2
S2	2	2	0	0
S3	2	2	0	0
S4	2	2	0	0
S5	1	1	2	0
S6	1	1	0	0
S7	1	1	2	0
S8	1	1	2	1
S9	1	1	2	0
S10	1	1	2	1
S11	1	1	2	1
S12	2	2	3	1
S13	2	2	1	0
S14	2	2	3	1
S15	1	1	1	1
S16	2	0	1	0
S17	2	0	1	1
S18	2	2	0	0
S19	2	2	0	0
S20	2	1	0	0
S21	1	1	0	0
S22	1	1	1	1
S23	2	2	4	2
S24	1	1	0	0
S25	1	1	1	1
S26	1	1	1	0
S27	2	2	0	0
S28	1	1	1	0
S29	2	2	1	1
S30	2	1	1	1
S31	1	1	0	0

Table 6: Problem solving ability percentage based indicators of problem solving

Indicators of Problem Solving	Score of Students	Total Score	Persentage	Category
Understanding problem	47	62	75,80%	Good
Planning	41	62	66,12%	Good Enough
Performing the plan	36	124	29,03%	Very Less
Confirmation the answer	15	62	24,19%	Very Less

Here is examples of students' answers on problem solving abilities test:

Problem:

1. Lisa has shaped cloth retangle and square. The area of the two clothes were same. The Circumference of the retangle cloth is 500 cm and the width is 90 cm.

a. What data obtained from those problems?
b. How to calculate the circumference of a square-shaped cloth?
c. Calculate the Circumference of square-shaped cloth!
d. Recheck the result in question c! Is the circumference of the square-shaped cloth is 480 cm? Explain!

Student's answer sheets:

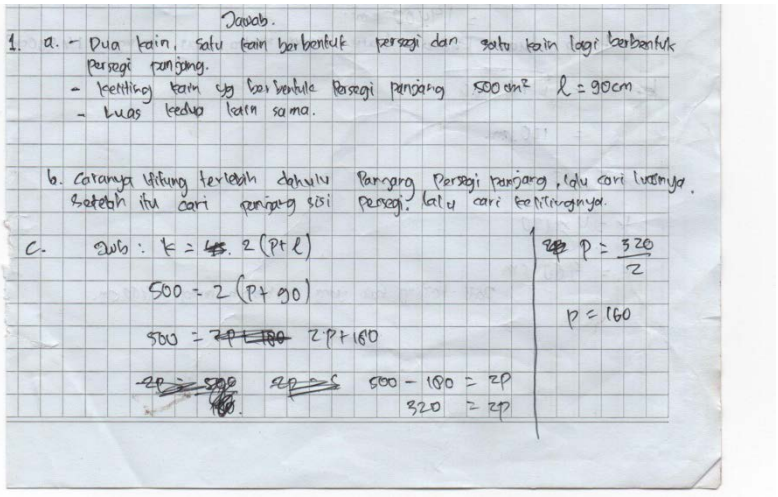

Figure 1: Student's answer sheet

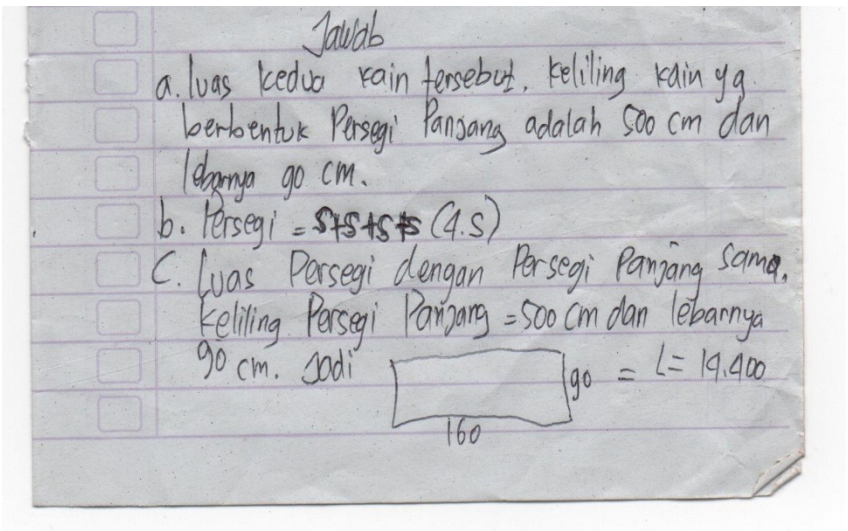

Figure 2: Student's answer sheet

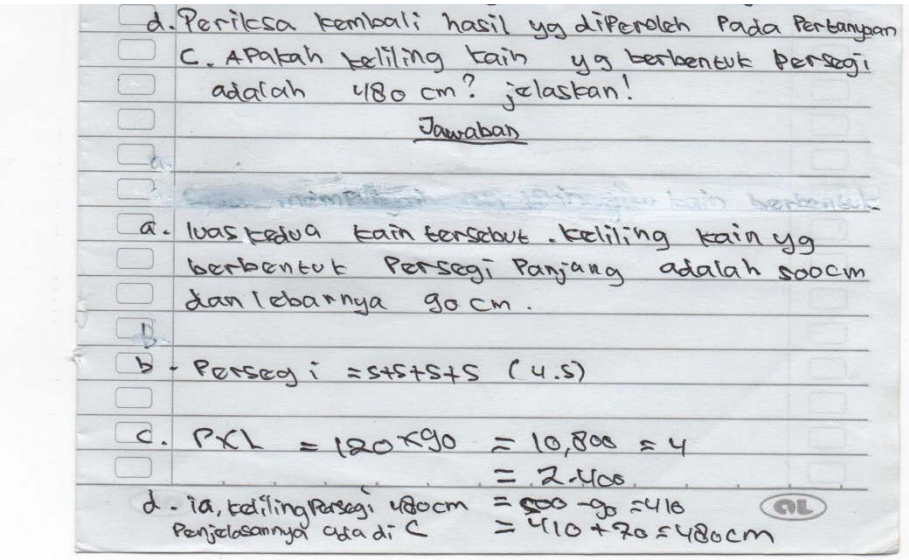

Figure 3: Student's answer sheet

From the picture above, can be obtained as:

- Student on Figure1 can answer the questions well. She can undesrtand problem and can make a planning too, then she can solve the problem well. Only 2 of 31 students can solve the problem well, that are S1 and S23.
- Student on Figure2 can't understand the problem well. He also can't make a planning, the he can performing the plan well.
- Student on Figure3 are not able to plan and solve problems at the same time in checking result from the answer, students just multiply the number contained in the problem.

4.2. Discussions

The results showed that most students of VII grade of SMP Negeri 4 Pancurbatu have not been able to solve the problem given to fulfill all phases of the indicators of the problem solving abilities. They can't solve the problem well. Polya [4] problem-solving is a process starting from the minute students are faced with the problem until the end when the problem is solved with four indicators of problem solving: understanding problem, planning, performing the plan, and confirmation the answer.

Based on students' answer sheet, the stage of problem solving which difficult for the students is the stage of the performing the plan and to confirmation the answer that were made. At the stage of devise the 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 [18]. In this study, devise plan is as same as performing the plan. To be able to solve the problem well, 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. 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 [19] . Then the class VII student should be already to have good problem solving ability. In addition, research is also consistent with research conducted by Fuadi [20] states that How important it is for us as humans to have the ability to solve a problem, as well as students are required to be able to have a problem-solving ability, especially the ability of mathematical problem solving. But based on the research showed that the students mathematical problem solving ability in terms of the indicators were not completely or very far from the expectation. Likewise with research Lubis [21] said that the average percentage reached 50% and classified in the not good category. It shows class in solving problems unresolved. Based on the result of the study, Polya's theory, and relevant reseacrh, the study had analyzed the problem solving ability by it's indicators. From the result, the students of VII grades of SMP Negeri 4 Pancurbatu can't solve problem well by use the indicators of problem solving.

5. Limitations

This study used only a method that analysis of students' mathematics problem solving ability of class VII SMP Negeri 4 Pancurbatu on Quadrilateral. The mathematic problem solving is analyzed by it's four indicator. The indicators are understanding problem, planning, performing the plan, and confirmation the answer.

6. Conclusions and Recommendations

6.1. Conclussions

Based on the analysis and discussion of the results of research conducted when referring to the purpose of study, it can be concluded that the persentage of students' problem solving ability in first indicator was 75,08%, the second indicator was 66,12 %, the third indicator was 29,03%, and the fourth indicator was 24,19%. Based on the research showed that the students mathematical problem solving ability in terms of the indicators were not completely.

6.2. Recommendations

Based on these results, the recommendations can be submitted by researcher are:

- for the teachers, it is better to train students in working on non-routine problems that aim to improve students' mathematical problem solving ability
- for the students, should be more active in learning mathematics to obtain a better learning outcomes and should always practice problem-solving ability and always discuss problems related to problem-solving ability test
- for other researchers, can make this as background issues in order to enhance students' mathematics problem solving abilities.

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