

Preliminary study on mathematical problem solving ability of junior high school students on the triangle subject

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Abstract. The triangle subject is a part of geometry concept. The subject is important to be mastered if a student wants to develop the geometrical ability. However, in the fact, some research reveal that Mathematical problem solving ability of students is still low because students are not yet accustomed to solve mathematical problems yet. The purpose of this study to determine the ability of mathematical problem solving students in junior high school on the triangle subject. This study was conducted by using descriptive qualitative method. The sample in this study is consisted of 32 students in the grade IX which was taken with purposive sampling technique. Data were collected through the test which consists of three essay questions based on the indicators: (1) identify the adequacy of the data; (2) create a mathematical model of daily problems and solve it; (3) select and implement strategies to solve mathematical problems; (4) interpret the results according to the origin of the problem and do the verification. The results of this study indicate that students difficulties in problem solving, and every student has different levels of mathematical problem solving ability.

1. Introduction

Geometry is a branch in mathematics. Learning mathematics school involves five content standards of contents, concept and number operation, geometry measurement, algebra and data analysis and opportunities [1]. Geometry consists of two viewpoints, based on the psychology viewpoint, geometry is a representation of abstraction of the visual experience and spatial, eg field, pattern, measurement, and mapping, also based on the mathematics viewpoint, geometry provides approaches to solve the problem, such as a picture, diagram, coordinate system, vectors, and transformation [2]. Learning geometry can foster the ability to think logically, develop problem solving ability and reasoning, and can support many other topics in mathematics [3].

One of the goals of learning geometry is for students to solve problems well [4]. Solving problem is an attempt to find a way out of a difficulty in order to achieve a goal that is not so immediately achievable [5]. Completing solving problem require complex rules or high level rules and high level rules can be achieved after mastering the rules and defined concept [6]. The importance of problem solving ability for students in mathematics, namely (1) the ability to solve the problem is a common goal of teaching mathematics; (2) Settlement of problems that include methods, procedures and strategies are core processes and major in mathematics curriculum; (3) Solving problem is a basic skills in mathematics [7].

However, some studies show that the ability of solving mathematical problems of students in Indonesia is very low. One of the reason is because students not accustomed to solve the problem

(non-routine problem) [8]. Based on the results of research conducted by The Third International Mathematics and Science Study (TIMSS) reflects the low ability of students' mathematical problem solving. From the results of TIMSS 2011, Indonesia is ranked 38th out of 42 countries with 386 score [9]. Obtained score by Indonesia is below average of international scoring which is 500. Based on the percentage achievement of mathematical problem solving ability in solving the problem is still low with an average of 38.25%, so the ability of students' mathematical problem solving needs to be improved [10]. Based on these facts, the teacher should understand the difficulties students and to help students develop mathematical problem solving ability.

The triangle subject is part of geometry concept. The triangle subject have an important role in help students to solve problems encounter. However, in the triangle subject many students have difficulty, especially in making the definition of triangle, determine and describe the triangle by type. The results showed that the low group of students still had difficulty in organizing the characteristics of the triangle and tending to incorrectly connect the triangle [11]. Based on the fact, teachers need to improve problem solving ability on the triangular subject.

Based on some study results show that students mathematical problem solving ability is still low and there are still many students who have difficulty in solving problems related to the subject of triangle, so this study aims to know the difficulty and level of mathematical problem solving ability students in the triangle subject, because this ability is the core of mathematics learning that can be applied in everyday life, with indicators used in this study are (1) identify the adequacy of the data; (2) create a mathematical model of daily problems and solve it; (3) select and implement strategies to solve mathematical problems; (4) interpret the results according to the origin of the problem and do the verification.

2. Experimental Method

This study was conducted by using descriptive qualitative method. All students in the school are population and 32 students of class IX as sample selected by purposive sampling technique. All the students taken have studied the triangle subject. Data from mathematical problem solving ability were collected by essay tests. Individual tests of three questions were performed for approximately 80 minutes. Furthermore, the data in the analysis with descriptive.

3. Result and Discussion

Based on the results of data analysis, it is obtained that average score of mathematical problem solving ability test is 4.48 with the maximum ideal score is 12. This shows that the students' mathematical problem solving ability is on a low level.

3.1. Analysis Problem 1 (Indicator 1)

Problem 1 for the indicator to identify the adequacy of the data that is "Fajar, Defitra and Elang ran together in a park in the form of an equilateral triangle. Fajar run at speed average 120 meters per minute while the Defitra 150 meters per minute. When they ran four laps, Defitra travel time faster 2 minutes than Fajar travel time. If the Elang only ran on one side of the park and it takes 8 minutes to run 4 times back and forth. Is it true that if the average speed of Elang is lower than Defitra and Fajar?"

From 32 students, there are 7 students who answered correctly, 26 students gave various errors of answer. One of the students' answers is shown in figure 1.

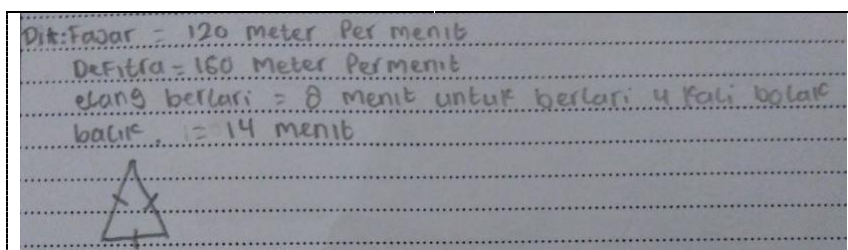


Figure 1. Photograph of student answer of problem 1

Figure 1 shows that students are unable to read the problems and concepts that exist in the problem and unable to write the data correctly and thoroughly, which is a prerequisite for solving the problem. This indicates that the low ability students in identifying the adequacy of the data to solve the problem.

3.2. Analysis Problem 2 (Indicator 2)

Triangle can be used to solve problems in daily life. This can be done by modeling the problem into a mathematical model. Problem 2 for the indicator makes mathematical model of a daily problem and solve it, namely "The front and back of the roof of a cage made of wood and the shape of an isosceles triangle. A farm has two similar enclosures with different sizes like figure 2 and figure 3.

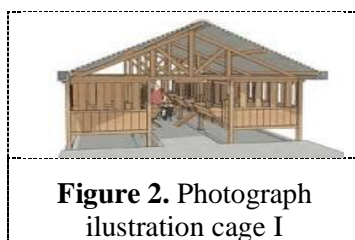


Figure 2. Photograph illustration cage I



Figure 3. Photograph illustration cage II

The following is data from the two cage shown in the table 1.

Table 1. The data of the cages

	Front and rear roof size		The cost of purchasing wood
	Pedestal	High	
Cage I	3 meter	1 meter	IDR 190.000
Cage II	4 meter	3 meter	IDR 340.000

The purchase cost includes the cost of shipping timber to a farm, cost the same on each shipment. If the third enclosure will be made and turned out the cost of purchasing wood for the front and rear roof is IDR 640,000, determine the size of the roof by first making a general equation."

From 32 students, there are 10 students who answered correctly, 22 students gave various errors of answer. One of the students' answers are shown in figure 4.

Figure 4. Photograph of student answer of problem 2

Figure 4 shows that the student has not been able to create a mathematical model of the presented problem so that the students' difficult to solve the problem. With making a mathematical model students can be expected to translate a problem into mathematical language by using the equation, inequality or function. This proves that the students ability to create a mathematical model is still low.

3.3. Analysis Problem 3 (Indicator 3 and 4)

Problem 3 for indicators of selecting and implementing a strategy for solving mathematical problems and interpreting the results according to the origin of the problem and to verify the namely "Figure 5 are a few pieces of triangular section at the base coincides ST. Give your explanation of measures to determine the amount of the settlement area of ΔPTQ and ΔRSQ .

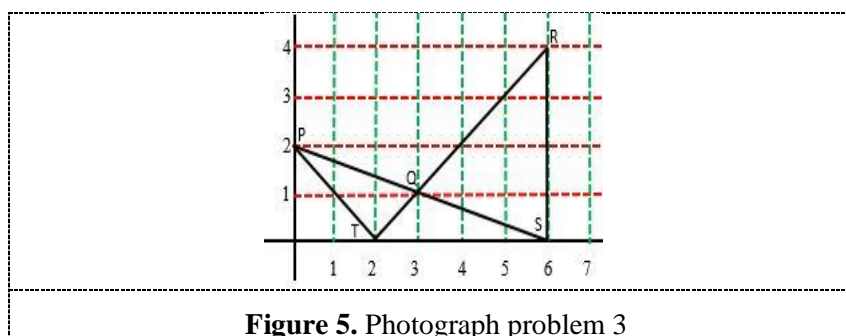


Figure 5. Photograph problem 3

From 32 students, there are 13 students who answered correctly, 19 students gave various errors of answer. One of the students' answers are shown in figure 6 and figure 7.

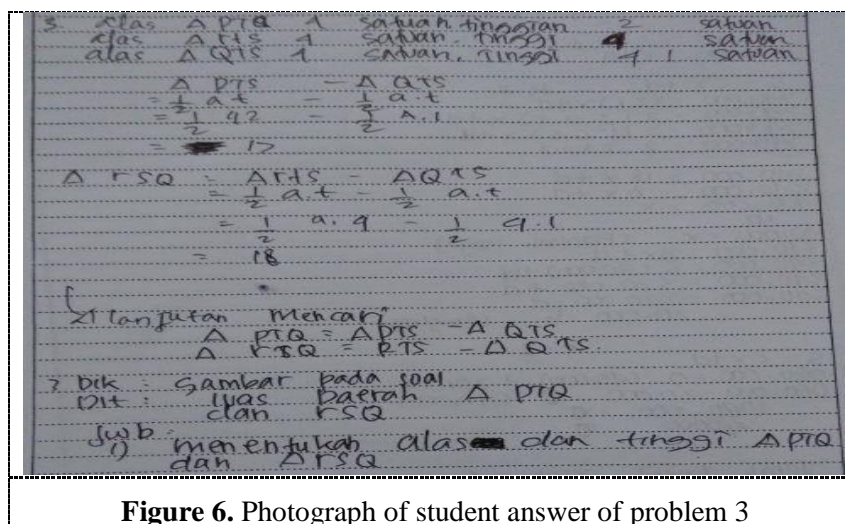


Figure 6. Photograph of student answer of problem 3

Figure 6 shows that students are not answered completely and procedural, so students had difficulty calculating spacious area ΔPTQ and ΔRSQ . By answering a question in sequence, it is expected to help students to determine what strategies can be taken to solve the problems appropriately. However, the fact that students have not been able to determine strategies that can be used. This shows that the students' ability to implement strategies to solve the problem is still low.

Diket = ΔPts , ΔQts , ΔRts
Diket = ΔPts dan ΔRSQ
Jawab = $L \Delta = \frac{1}{2} \times a \times t$
 $\Delta = Pts = \frac{1}{2} \times 4 \times 2 = 4$
 $\Delta = Qts = \frac{1}{2} \times 4 \times 1 = 2$
 $\Delta = Rts = \frac{1}{2} \times 4 \times 4 = 8$
 $\Delta = Pts - \Delta Qts = 4 - 2 = 2$
 $\Delta = RSQ - \Delta Qts = 8 - 2 = 6$

Figure 7. Photograph of student answer of problem 3

Figure 7 shows the majority of students are not verified because of limited time, and if there are time they only verify the calculation, not the accuracy of the concepts used. Students just verify spacious area ΔPts and ΔRSQ using triangle formula, students are wrong in entering base and high value so the answer is wrong. This shows that the students' ability to verify is still low.

4. Conclusion

Based on the results of the study showed that almost all students have low mathematical problem solving ability in the indicators (1) identify the adequacy of data; (2) create a mathematical model of a daily problem and solve it; (3) selecting and implementing strategies to solve math problems; (4) interpreting the results according to the original problem as well as verifying the triangular material. This is stated in the answer of student number 1, where the students are not able to read the problem correctly, so the students have difficulties in reading the concept of what is on the problem, and on the answer of student number 2, which has not been able to make the mathematical model, so the student difficulties in solving the problem, also student answer number 3, where the students did not answer procedurally, the students had difficulties to determine the strategy and there were some students who did the verification, but only verified on the calculation only, not on the accuracy of the concept used. In addition, based on data obtained research results indicate that each student has a different level of mathematical problem solving ability. Therefore, efforts to overcome student difficulties and equalize students mathematical problem solving ability, teachers must plan for the selection of appropriate approaches to the learning process, so as to minimize mistakes and optimize students mathematical problem solving ability.

5. Acknowledgments

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6. References

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