

The analysis of students' reflective thinking skills in solving mathematical story problems on quadrilateral material

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Abstract. The ability of reflective thinking is very important for every student to have. Reflective thinking is an activity that makes students try to connect the knowledge gained to solve new problems related to old knowledge. Story problem solving is an activity that can connect the reflective thinking ability of students. This study aimed to describe the reflective thinking skills of Grade VII students of SMP Muhammadiyah 3 Bandar Lampung in solving story questions on quadrilateral. Data obtained through analysis of reflective thinking ability tests consisting of 2 items of mathematical story questions covering 3 aspects of reflective thinking indicators namely reacting, comparing, and contemplating. The research subjects in this study were divided based on their ability level. The results showed that the students' reflective thinking ability was still not optimal. From the results of the analysis, high ability students can be said to be reflective, moderate abilities are said to be quite reflective, and low abilities are said to be less reflective.

1. Introduction

Mathematics is an activity of human life, providing understanding that mathematical concepts and skills can be found and applied in various activities of human life [1]. Students' problem solving skills in learning mathematics need to be developed so that students are not only given formulas and questions but also trained to learn through the problem itself. According to Sabandar [2] students can learn how to solve mathematical problems through their thinking skills. Students will remember, recognize the relationship between concepts, causal relations, analogy relationships, or differences so that it influences decision making or conclusions quickly and accurately. As revealed by Arends & Kilcher [3] about the reflective thinking process that is "reflective thinking is looking within disposition to be metacognitive: Thinking that is about one's own thinking and the particular disposition to actively monitor, regulate, and evaluate one's thinking". Reflective thinking is the process of remembering, matching, and evaluating thinking about something. The ability to think reflective mathematics is one focus in learning mathematics, because with this it will help students in remembering and connecting ideas or ideas that are owned with problems in his life so as to create concrete solutions.

In studying mathematics, students must think so that they are able to understand the mathematical concepts learned and be able to use these concepts appropriately when they need to find answers to various math problems. Mathematical problems faced by someone are often not immediately able to find a solution while he is expected and demanded to be able to solve these problems, especially in the form of a story. The story is a problem that is stated in the form of meaningful sentences and easy to

understand. The story can be presented in oral or written form, the problem of the story in writing in the form of a sentence that illustrates the activities in daily life [4].

Story questions are useful for applying knowledge possessed by previous students. Story problem solving is a problem solving activity. Problem solving is in harmony with reflective thinking activities. Problem abolition in mathematical story problems is a process that contains correct and logical steps to get a solution [5]. In solving a mathematical story problem is not just getting results in the form of answers to the questions asked, but more importantly students must know and understand the thought process or steps to get the answer. Therefore he needs to have the skills to think so that he can find the right way to solve the problems he faces.

Activities or thought processes undertaken so that someone is able to solve a mathematical problem has a relationship with the ability to remember, recognize the relationship between mathematical concepts, realize the existence of a causal relationship, an analogy or difference, which can then bring up original ideas, and smoothly and flexible in making decisions or conclusions quickly and precisely. Learning activities that emphasize the learning process will certainly bring thinking activities in various forms and levels. The thought process that is built from the beginning in an effort to solve a problem should take place intentionally and through to completion. Completeness in this case is meant that students must undergo the process so that they have been trained and have the opportunity to empower and function their abilities so that they understand and master what they learn and do. Thus students must be trained to have mathematical thinking skills, one of which is mathematical reflective thinking.

Reflective thinking is an activity that makes students try to connect the knowledge gained to solve new problems related to old knowledge. Students who think reflectively realize what is known and what is needed, it is very important to connect the gaps in the learning situation [6]. The development of reflective thinking has become the focus and importance of mathematics education because it is the core of mathematics education and it is one of the higher-order thinking abilities [7]. Gurol states that reflective thinking is very important for students and teachers [8]. However, in learning mathematics reflective thinking is still rare and difficult to introduce so that it does not get the attention of the teacher. Mathematical reflective thinking ability is one of the determining factors for students' success in solving mathematical problems. Therefore reflective thinking needs to get the teacher's attention. However, most teacher evaluation processes only pay attention to the final results of problem solving by students, without regard to how students solve problems. In line with the statement made by Sabandar that mathematical reflective thinking is still rarely introduced by teachers and developed in junior high school students. Such learning conditions are one of the reasons for the low ability to think mathematically [9].

Noer explained that the reflective thinking ability possessed by students can be seen through three phases / levels, namely reacting, comparing, and contemplating [10].

1. Reacting, namely reacting with a personal understanding of events, stimulation, or mathematical problems by focusing on the nature of the situation.
2. Comparing, which is analyzing and clarifying what individual experiences are believed by comparing reactions with other experiences, such as referring to a general principle or a theory.
3. Contemplating, which prioritizes a deep personal understanding. In this case the focus on a personal level in processes such as describing, informing, considering, and reconstructing a situation or problem.

Indicators of reflective thinking ability used in this study are described in Table 1.

Table 1. Indicators of reflective thinking ability

Indicator	Definition
<i>Reacting</i>	Reflective thinking for action. Write down the characteristics possessed by the situation then answer the problem.
<i>Comparing</i>	Reflective thinking for evaluation. Comparing a reaction with a general principle or theory by giving reasons why choosing the action.
<i>Contemplating</i>	Reflective thinking for critical inquiry. Inform answers based on problem situations, contrast answers with other answers then reconstruct situations.

While the indicators in this study are the adaptation results of the indicators in Table 1. As for the indicators used in this study are presented in Table 2.

Tabel 2. Indicators of reflective thinking ability

Phase	Indicator
<i>Reacting</i>	Mention what is known
	Mention what was asked
	Being able to explain that what is known is enough to answer the question
<i>Comparing</i>	Explain the methods that are considered effective and have been used to solve rectangular material story problems
	Explain methods that are considered effective and will be carried out to solve rectangular material story problems.
	Linking the problem in question with the quadrilateral material problem encountered.
<i>Contemplating</i>	Resolving quadrilateral material story problems using methods that are considered effective
	Detects if there is an error determining the answer
	Correcting and explaining if mistakes occur in solving the rectangular material story problem
	Students can make conclusions correctly

Based on the description stated above, this study aims to describe the ability of students' reflective thinking in solving mathematical problems.

2. Method

This research is a descriptive study with a qualitative approach. The subjects in this study were 6 VII grade students of SMP Muhammadiyah 3 Bandar Lampung in the even semester of the 2018/2019 academic year, consisting of two students with high mathematical abilities, two students with medium abilities, and two students with low initial abilities. The selection of research subjects was done by purposive sampling. The subject selection criteria in this study were able to express opinions and ways of thinking both verbally and in writing based on recommendations from mathematics teachers. In this study the data were obtained from the reflective thinking ability test consisting of 2 story items covering 3 aspects of reflective thinking indicators namely reacting, comparing, and contemplating. Test results or data in this study will be material to be analyzed regarding the ability of reflective thinking in solving story problems. Interviews are conducted in depth (in depth interviews) and are semi-structured.

The data obtained were analyzed using the indicator guidelines that have been created to obtain student data that can be subject to interviews. Data analysis techniques are carried out by: (1) data collection, (2) data reduction, reduction of unnecessary information, organizing data, and verifying

student answers, (3) data display, data is presented in the form of narrative text prepared by good and coherent so that it is easily seen, read, and understood, and (4) verification and confirmation of conclusions.

3. Result and Discussion

Interview results that have been analyzed are then compared to obtain valid data. Furthermore, it can be seen the reflective thinking process of students in solving mathematical story problems. The reflective thinking process of students in solving math story problems can be seen in Table 3.

Table 3. Levels of students' reflective thinking ability in aompleting matter of mathematical stories

Subject	Cognitive ability Mathematic	Question	
		1	2
Student 1	High	Reflective	Reflective
Student 2	High	Reflective	Reflective
Student 3	Medium	Reflective	Enough
Student 4	Medium	Enough	Enough
Student 5	Low	Less	Less
Student 6	Low	Less	Less

Based on the analysis of the data that has been done, it is known that student 1, that is, students who have high mathematical cognitive ability in meeting the Reacting phase in question number 1, are able to express what is known and what is asked very clearly and in detail. Student 1 can also explain that what is known is enough to answer the question. In fulfilling the Comparing phase, student 1 can explain effective methods in solving the given story problem. Then in fulfilling the Contemplating phase, student 1 can explain how to work it clearly and correctly, student 1 can also detect errors in the answers expressed. For question point number 1 it can be concluded that for the process of thinking in solving math problems student 1 is reflective. The following shows the answers of student 1 with hih cognitive abilities for question number 1.

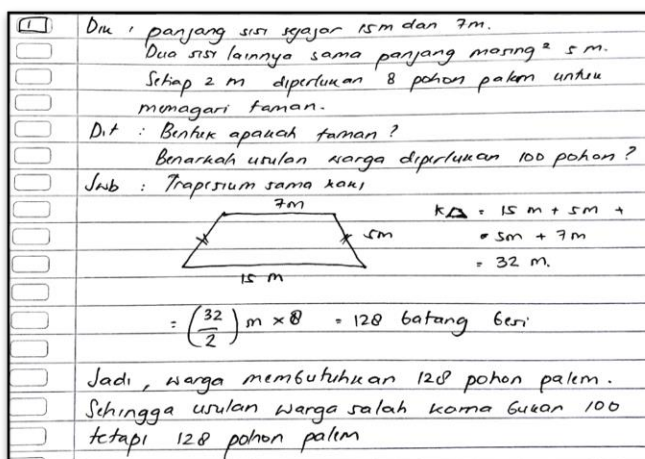


Figure 1. Answer student 1 for question number 1

For question point number 2, student 1 in fulfilling the Reacting phase can mention what is known in the problem very well. Student 1 can also state what is asked and can name the relationship. In fulfilling the Comparing phase, student 1 can link the problem being asked with a problem that has been encountered. Then in the *Contemplating* phase, student 1 can explain how to work it correctly. The student can also detect errors in the answer. So it can be concluded that student 1 in solving problem number 2 is reflective. Likewise, students 2 in working on the two questions can pass through the three phases in the stages of reflective thinking very well, namely the Reacting, Comparing and

Contemplating phases. The following shows the answers of student 1 with high cognitive abilities for question number 2.

Dik : Ukuran lantai ruang makan : 4m x 5m
 Ukuran keramik : 40 cm x 40 cm
 Dit : Apakah benar diperlukan 120 buah keramik
 untuk menutupi lantai di ruang makan Nidya?
 Jwb : Luas ruang makan : 4m x 5m
 $= 400 \times 500 \text{ cm}$
 $= 200.000 \text{ cm}^2$

 L 1 keramik : 40 cm x 40 cm
 $= 1600 \text{ cm}^2$

 Jadi : $\frac{\text{L. ruang makan}}{\text{L. 1 keramik}}$
 $= \frac{200.000}{1600}$
 $= 125 \text{ keramik.}$

 Jadi, Nidya membutuhkan 125 Colong ~~120~~ keramik
 untuk menutupi lantai di ruang makan.
 Jadi, pendapat widya salah karena bukan 120 tetapi
 125 buah keramik.

Figure 2. Answer student 1 for question number 2

Furthermore, the analysis has been done to students who have moderate cognitive, namely students 3 and students 4. Students 3 in the Reacting phase in problem number 1 is students can mention what is known in the problem, can mention what is asked, and can also explain the relationship between what is known and what is asked. In the Comparing phase, students 3 can remember problems that they had previously had. Student 3 can also explain the relationship. Then in the *Contemplating* phase, student 3 can conclude well. Student 3 can also detect errors in the answer. From problem number 1, student 3 can be said to be reflective. Student 3 in question number 2 can fulfill the Reacting phase because students can correctly say what is known in the problem. Student 3 can also mention what is asked by questions in number 2, and can explain the connection. In the Comparing phase, students can remember the problems they have faced, and have similarities with the problems they are currently facing. Student 2 can also explain the relationship or relationship between the problems that have been faced before with the current problem. While in the Contemplating phase, student 3 cannot explain how to do it correctly, and cannot detect errors in his work. So, in problem number 2, student 3 can be said to be quite reflective, because it only goes through the Reacting and Comparing phases.

Based on the analysis conducted on student 4, it is known that student 4 in fulfilling the Reacting phase in question number 1 is able to mention what is known in the problem well, students can also mention what is asked of the problem and can explain it. In the Comparing phase, students cannot relate the problem being asked to that which is clearly known. And in the Contemplating phase students 4 can detect mistakes made. The subject can also explain the problems that have been faced before, and can explain the relationship. So in problem number 1, student 4 can be said to be quite reflective, because it can only go through the Reacting phase and the Contemplating phase. Furthermore, student 4 in working on question number 2, can fulfill the Reacting phase that is able to mention what is known in the problem. Students can also mention what is known, and can explain the relationship of what is known and what is asked. However, in the Comparing phase 4 students could not explain the methods that were considered effective in solving story problems. So in question number 2, student 4 can be said to be less reflective, because it can only go through the Reacting phase and the Comparing phase.

Furthermore, the analysis conducted to students who have low mathematical cognitive, namely students 5 and students 6. Students 5 in the Reacting phase in problem number 1 is that students can only mention what is known in the problem, but cannot mention what is asked, and cannot explain the relationship between what is known and what is asked. In the Comparing phase, students 5 also cannot remember problems that they had previously had. Student 3 also cannot explain the relationship. So, in the *Contemplating* phase, student 5 cannot fulfill that phase. From problem number 1, student 5 can be said to be less reflective. Student 5 in question number 2 also cannot fulfill the Reacting phase because students cannot correctly state what is known in the problem. Student 5 also cannot mention what was asked by the problem in number 2, so it cannot explain the connection. In the Comparing phase, students finally cannot explain the relationship or the relationship between the problems that have been faced

before with the current problem. In the Contemplating phase, student 5 cannot explain how to do it correctly. So, in problem number 2, student 5 can be said to be less reflective, because it cannot pass through the three phases of reflective thinking properly. So is the case with student 6, who did not go through the three phases of reflective thinking well in dealing with both questions. So students can be said to be less reflective.

4. Conclusion

Based on the results of research and discussion, about the reflective thinking process, it was found that student 1 with high cognitive ability can go through the three phases of the reflective thinking indicator in solving both the given story problems, so that it can be said that student 1 can think reflective. Likewise with student 2 with high cognitive abilities also exhibits reflective thinking processes. Student 2 can solve both questions through 3 phases on the indicator of reflective thinking well. Furthermore, students 3 with cognitive abilities are showing reflective thinking processes enough to solve mathematical story problems, student 3 can go through all three phases in problem number 1 well. However, in question number 2, student 3 can only pass 2 phases. Student 4 with the same ability only went through 2 phases in the first and second questions. So student 4 shows the process of thinking is quite reflective in solving mathematical story problems. Another case with students 5 and 6 students with low mathematical cognitive abilities shows the same thought process, which is less reflective in solving math story problems. Students 5 and 6 only go through 1 phase on the two questions given, the Reacting phase so students 5 and students can be said to be less reflective.

From the results of the analysis, it can be concluded that students with high cognitive abilities can be said to be reflective in solving mathematical story problems. Furthermore, students with moderate abilities are said to be quite reflective, and students with low abilities are said to be less reflective in solving math story problems.

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