

## The Analysis Of Mathematics Reflective Thinking Skills Of High School Students In Completing Trigonometry Problems

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**Abstract.** This study aims to determine the students' mathematical reflective thinking skills in trigonometric material. The subjects in this study were students of 11th Science grade in SMAN 1 Gedong Tataan, totaling 30 students. The method used in this research is descriptive qualitative. The data were collected using the instrument of reflective thinking skills in trigonometric learning. The data were analyzed qualitatively and quantitatively to get a comprehensive description related to the students' mathematical reflective thinking skills. Furthermore the data collected was analyzed based on indicators of reflective thinking skills that have been determined by researchers which include Reacting, Comparing and Contemplating. The results of the data analysis in question number 1 obtained the results, namely: (a) on the reacting indicator, as many as 43.3% of students were able to use reacting well; (b) on the Comparing indicator, as many as 30% of students can use Comparing well; (c) on the Contemplating indicator, as many as 30% of students can use Contemplating properly. Whereas in problem number 2 the results obtained are: (a) in the reacting indicator, as many as 46.7% of students can use reacting well; (b) on the Comparing indicator, 36.6% of students can use Comparing well; (c) on the Contemplating indicator, 33.3% of students can use Contemplating well. The results of the study showed that the students' reflective thinking skills was still low. These results prove that students' reflective thinking skills still need to be trained further in order to be improved.

### 1. Introduction

Mathematics is one of the sciences taught in the schools from the basic education to the high education. Even early on, a child has been introduced to mathematics by his parents through knowing numbers and counting. The role of mathematics is very important in the field of education. Mathematics can be used as a tool to overcome the problems encountered in everyday life. As in the opinion of Suherman [1] mathematics is the queen and stewards of science. It is intended that mathematics is as a source of other sciences. Therefore, the role of mathematics in the development of science and technology is clearly very important. Learning mathematics in schools is not only aimed at making students understand the mathematics taught. Other main objectives, for example the ability of mathematical reasoning, mathematical communication, mathematical connections, mathematical representation and

mathematical problem solving, and certain behaviors that students must obtain after they study mathematics. In studying mathematics people must think so that they are able to understand the mathematical concepts learned and be able to use these concepts appropriately when they have to find the answers to various mathematical problems. Mathematical problems faced by someone are often not immediately able to find a solution while they are expected and demanded to be able to solve the problem. Therefore they need to have thinking skills so that they can find the right way to solve the problems they face. 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 the 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 the students must undergo the process so that they have been trained and have the opportunity to empower and functioning their abilities so that they understand and mastering what they learn and do. Thus the students must be trained in order to have the mathematical thinking skills, one of which is reflective thinking of mathematics.

According to Chee [2] states that the reflective thinking is an awareness of what is known and what is needed, this is very important to bridge the learning situation gap. In addition, Gurol [3] defines the reflective thinking as a process of directed and appropriate activities where individuals realize to be followed, analyze, evaluate, motivate, get deep meaning, use appropriate learning strategies. Thus the teacher's reflective thinking aims to achieve the learning targets and produce new learning approaches that have a direct impact on the learning process. Choy [4] states that the reflective thinking is defined as awareness of what is known and what is needed, this is very important to bridge the learning situation gap. Reflective thinking is a thinking activity that can make the students try to connect the knowledge they have acquired to solve new problems related to their old knowledge. In mathematics learning, reflective thinking skills is said to be important, because several previous studies by Noer [5] have shown that the learning strategies that use reflective thinking processes provide better results when compared to the students who study with an ordinary learning. To find out the students' reflective thinking skills, a teacher needs to provide the activities that can see the students' reflective thinking skills. One of these activities is solving mathematical problems related to the students' daily activities. But so far the teacher still has not optimized the student's reflective thinking skills, the teacher tends to give mathematical problems in accordance with existing problems without modifying in accordance with students' daily activities. This makes students think that mathematics lacks benefits in daily activities of students and teachers also do not optimize the student reflective thinking optimally and effectively. This is in line with Mason [6] who says that reflective thinking activities are often not carried out effectively. Noer [7] divides the three steps in reflective thinking ability, namely Reacting Phase, Comparing Phase, Contemplating Phase.

Indicators of reflective thinking ability used in this study are as shown in **Table 1**.

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

With the description above, the researcher tries to analyze the students' reflective thinking skills by solving mathematical problems. In this study trigonometric material was chosen, using trigonometric problem forms that connect the students in daily activities.

## **2. Research Methods**

The method used in this research is descriptive qualitative. This research was conducted at SMAN 1 Gedong Tataan Pesawaran District. The subjects of this study were 30 students of 11th Science grade of SMAN 1 Gedong Tataan in the odd semester of 2019-2020 who had taken Trigonometry material and the subjects were selected by purposive sampling through interviews in the high, medium and low categories. From the interview results obtained 10 students in the high category, 12 students in the medium category and 8 students in the low category. In this study the data were obtained from the results of the reflective thinking skills test which consisted of two essay items.

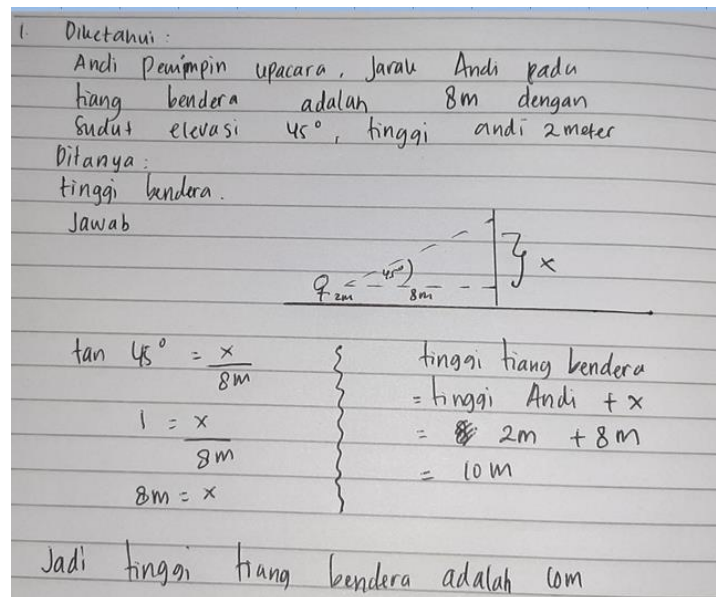
## **3. The Research Result**

The reflective thinking skills test used by the researchers to retrieve data consists of two problems regarding trigonometric material. Problem number 1 "Andi is the leader of the ceremony at the 74th anniversary of the Republic of Indonesia which was held at one of the schools, at the moment of raising the flag all the participants of the ceremony saluted the flag including Andi. The distance of the flagpole is 8 meters with an elevation angle of  $45^{\circ}$  and the height of 2 meters, calculate the height of the flagpole? Problem number 2" A plane sank in the middle of the sea at a depth of 850 meters. The rescue ship was prepared to find the plane. The rescue ship detected an aircraft that sank with sonar. The rescue ship detected an angle of  $30^{\circ}$ . A diver will dive straight from the rescue ship to the sinking plane. What is the distance the diver must travel to the plane?" Two questions were given to 30 students of 11th grade class with 30 minutes to work on. The results of these tests obtained the data in the form of student work which then the researcher analyzes based on the rubric that the researcher has compiled.

For problem number 1, the reacting indicator, as many as 13 students can meet the reacting indicator very well. The thirteen students can express in their own sentence what is known from the problem and be able to describe the problem exactly according to the problem given. On the other hand, there are also 17 students who are able to express in their own sentence what is known from the problem and what is asked on the problem, but have not been able to describe the problem correctly from the given problem. This shows that the initial knowledge of the students is still lacking. From this result, it indicates that the students' reacting skills is still low because only 43.3% of students can meet the reacting indicators well.

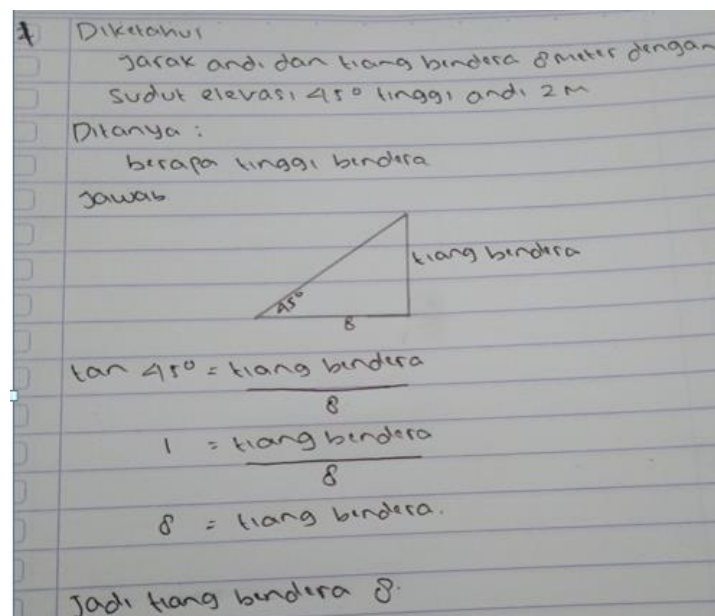
In the Comparing indicator, as many as 9 students who can answer correctly on problems that have been solved and use methods that are considered effective for solving problems, can explain the relationships and the problems that have been faced with the problems currently faced. Meanwhile, 9 students can explain the methods that have been and will be used to solve problem number 1, but the students' explanations are still wrong. While 12 other students have not been able to use effective methods in solving questions number 1 given. These results indicate that the students on the comparing indicator are still low because only 30% of students are able to solve the answers correctly on the problems given and use methods that are considered effective for solving problems.

In the Contemplating indicator, 9 students can complete the given problem, and they are able to deduce the answer to the problem correctly. While 9 other students were able to make a solution of the problem but could not make a conclusion. While 12 other students have not been able to make a solution of the problem and have not been able to make conclusions. From these results it indicates that students on the Contemplating indicator are still low because only 30% of students in this phase are able to make a solution correctly.



Picture 1. One of the results of student work for question no.1

In Figure 1 in reacting phase the students can review the information contained in the problem, in this phase they can mention what is known and asked properly according to the information in the problem. Then the comparison phase here they can describe the information they can and at this stage they're able to analyze well the methods they can use in solving the problems presented. Furthermore, for the contemplating phase they can solve the problem correctly and can conclude the results they got correctly. In figure no. 1 with question number one, the students have good reflective thinking skills.



Picture 2. One of the results of student work for question no.1

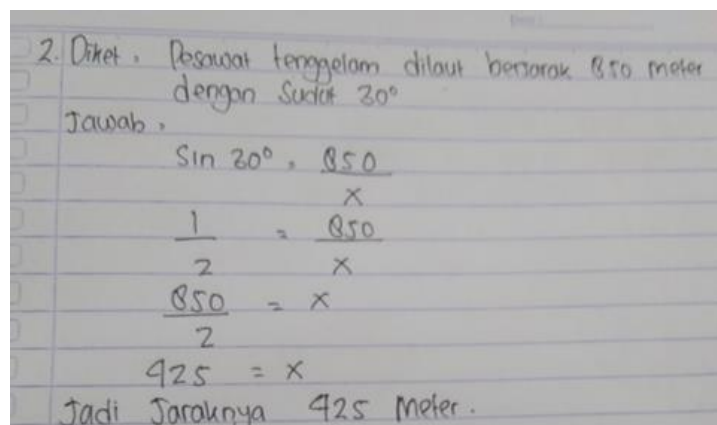
In figure number 2 in the reacting phase the students can review the information contained in the problem, in this phase the students can mention what is known and asked properly according to the

information in the problem but in the comparison phase they lack in analyzing the problem, this is proportional to what they described in solving the problem. In the contemplating phase the students cannot deduce correctly the given problem. In figure number 2 with question number one the students have low reflective thinking skills.

For problem number 2, the reacting indicator, as many as 14 students can meet the reacting indicator very well. The sixteen students are able to express in their own sentence what is known from the problem and what is asked, able to describe the information contained in the problem correctly. On the other hand, there are also 16 students who are able to express in their own sentences what is known from the problem and what is asked about the problem, but have not been able to describe the information provided correctly. From this result, it indicates that the students' reacting skills is still low because only 46.7% of students can meet the reacting indicators well.

In the Comparing indicator, as many as 11 students who can explain answers to problems that have been solved and use effective methods to solve problems, can explain the relationships and problems that have been faced with the problems currently being faced. Meanwhile, 10 students can use the methods that have been and will be used to solve problem number 2, but students' explanations are still wrong. While 9 other students have not been able to use effective methods in solving questions number 2 given. From these results it indicates that the students on the Comparing indicator are still low because only 36.6% of students solve the problems given correctly.

In the Contemplating indicator, 10 students can complete the given problem, and students are able to deduce the answer to the problem correctly. While 8 other students were able to make a solution of the problem but could not make a conclusion. While 12 other students have not been able to make a solution of the problem and have not been able to make conclusions. From this result, it indicates that the students on the Contemplating indicator are still low because only 33.3% of students in this phase are able to make a solution correctly.



2. Diket. Pesawat tenggelam dilaut berarak 850 meter dengan sudut 30°  
Jawab.  
 $\sin 30^\circ = \frac{850}{x}$   
 $\frac{1}{2} = \frac{850}{x}$   
 $\frac{850}{2} = x$   
 $425 = x$   
Jadi Jaraknya 425 Meter.

Picture 3. One of the results of student work for question no.2

In figure number 3 in the reacting phase the students cannot understand the problem so they cannot write what is known and what is asked according to the problem in the problem. In the comparison phase the students are able to use the method appropriately in solving given problems but in solving problems students are still wrong in answering. In the contemplating phase the students cannot conclude the answers correctly. In figure number 3 with question number two the students have low reflective thinking skills.

#### 4. Conclusion

Based on the results of the data analysis in the results and discussion sub-chapter, it can be concluded that the reflective thinking skills of the students of SMAN 1 Gedong Tataan at 11th grade class is still relatively low. That is because the students who meet each indicator of reflective thinking skills are still

under 50%. Especially the reacting, comparing and contemplating indicators which are still very low. This condition is due to the fact that most students still experience difficulties in building a deep understanding of the problem and the inability to convey what they understand in the form of appropriate reasons, this is indicated by the inability of students to provide answers at the comparative and contemplating stages so that students do not can conclude the answer correctly. The results of the analysis of students 'reflective thinking skills are expected to be considered by the teacher in making improvements, thus encouraging students' thinking in order to obtain the best strategy to achieve the learning objectives.

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