

Students' difficulties in trigonometry: A case study in Madrasah Aliyah (MA) Al Iman Bulus Purworejo

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Abstract

This research aims to describe the students' difficulties in accomplishing trigonometry. This research used a descriptive qualitative method. The population of this research was the tenth-grade students of Madrasah Aliyah (MA) Al Iman Bulus Purworejo. The data collection of the study was a problem-solving test and interview. The validity was obtained using the triangulation method, comparing collected data from the test and interview. Data analysis was done through three steps, data reduction, data presentation, and conclusion. An analytical framework was developed based on Polya method. The research results were: (1) The students struggled to understand the sentences (pictures) or terms in the test items, so they were confused about which one should be known and asked. (2) The students could understand the information from the test items but could not write down the completion. (3) The students were unable to carry out the completion planning, such as having difficulty understanding the problems, slipshod, and doing the test hurriedly. (4) The students were reluctant to review the answers. They only saw the written answers without checking whether their answers were right or wrong.

Keywords: Polya, students' difficulties, trigonometry

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INTRODUCTION

Mathematics is a needed lesson for students to solve the problems in their life. Mathematics also plays an essential role in various knowledge. The development of science cannot be separated from it, so it is evident that Mathematics is taught from elementary to senior high school. According to Harini (2012: 159) Mathematics is universal knowledge which underlies the development of modern technology, has an important role in various field, and improve the human's way of thinking. Meanwhile, Sundayana (2013: 2) stated that Mathematics is one of the components of the whole lesson that has an important role in education. Yet, there are a lot of students who consider Mathematics as a complex, tedious, scary, and disgusting lesson. The difficulty experienced by the students in studying Mathematics gives a clue that they have not understood the material yet (Rahayuningrum & Setyawan, 2019). Besides, they also have a problem with compelling Mathematics items. Those difficulties also occur in trigonometry. The learning process that forces them to understand, memorize and apply the formulas to finish things leads them to the problem. Trigonometry items are not easy to solve because of a specific problem sequence. In trigonometry, the students need to be trained and guided by combining the counting skill and applying formulas.

All the difficulties can be analyzed, so the problems come to an end. One of the alternatives to solve the problem is using the Polya method. Polya (Hamiyah & Jauhar, 2014: 115) applied the steps in compelling a problem in sequence. Polya presented how to solve the problem

interestingly and theories during the learning process. By using four steps in solving a specific situation, it is hoped that the students will not find the difficulties anymore. Polya stated that problem-solving encompasses four steps: (a) understanding the problem. In this case, the students cannot solve the problem correctly without grasping the given problem. (b) Planning the solution. After understanding the problem well, the students lead to construct the planned solution. (c) Resolving the problem based on planning. After planning the solution well, the students can solve the problem based on the planning, which is considered the best. (d) Re-checking all the steps which have been done. The last step, according to Polya, is re-checking the answers from the first until the third step.

Based on the observation during the teaching and learning process in MA Al Bulus in trigonometry, some students had not done the test precisely in counting and understanding the concept. In this matter, those who experienced the difficulties need to be analyzed for the exact problems that led them to the matter.

RESEARCH METHOD

Researchers used descriptive qualitative methods in conducting research. The subjects in this are the students in Madrasah Aliyah (MA) Al Iman Bulus Purworejo. The number of students is 24. Choosing the subject is based on the experience of researchers when teaching often encounters class X students' mistakes in solving Trigonometry questions. The technique of obtaining samples in this study used a purposive sampling technique because the subjects were selected based on special characteristics determined by the researcher following the research objectives.

The data collection technique used was a written test of the description type and interview. The description-type written test is used to find out the student's difficulties in learning trigonometry, while the interview is used to determine the factors that cause these difficulties. The test consisted of five questions related to trigonometry and was tested on 24 students. Then after the test was carried out and the results were obtained, four students were selected as samples for interviews. The selection of the interview sample was based on the results of student answers representing the majority of answers. The answer test will be analyzed based on Polya's (2004) steps: (1) understand the problem. Students must be able to identify known and asked elements and check the suitability of elements to solve problems, (2) develop plans. Students must be able to link the relationship between known and asked elements, then compile mathematical models/sentences by including mathematical concepts/formulas used to solve problems, (3) carry out a settlement plan. Students must be able to complete mathematical models/sentences by detailing the completion steps and (4) re-examine the truth solutions. Students must be able to check the correctness of the answers by lowering the results differently and interpreting them.

RESULTS AND DISCUSSION

After analyzing the data done by the researcher, he got the data from four subjects of the researchers who found difficulties in dealing with the problems related to trigonometry with each difficulty based on the Polya method. From the analysis of four research subjects developed based on the Polya method. (Understanding the problem, planning, implementing the solution and re-checking).

Understanding the problem

In this stage, it is shown that the students experienced determining what they know and asked. Several students did not write down what they knew and asked in the test items because they tended to write the answer and steps in finishing the questions.

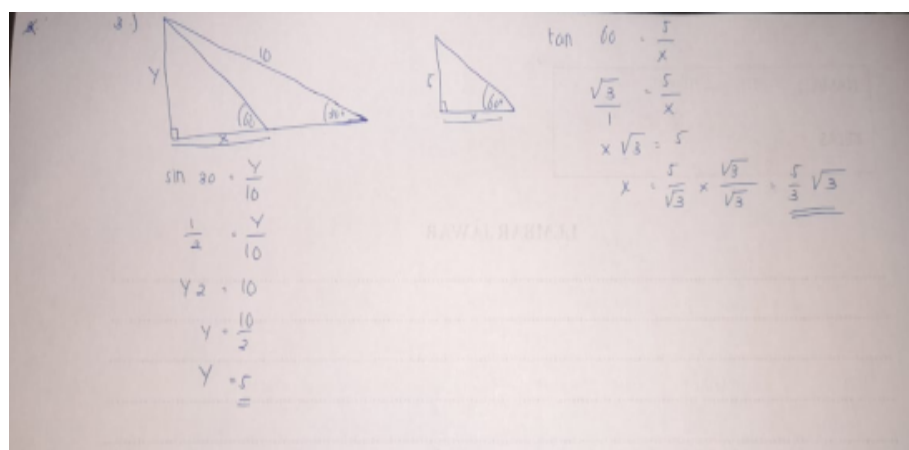


Figure 1. Student's difficulties in understanding the problem

Figure 1 shows that the students have difficulty writing down what they know and what they have been asked. According to the interview, the problem appeared because they did not understand pictorial test items, so they were confused about what they knew and what the test item had asked.

The Stage of Planning the Solution

In this stage, the students had difficulty determining the formulas for the test items. Most of them had written down what they knew and what had been asked but did not plan the solution or the formulas they used to find out the solution, the reason that they understood the problem. The analysis of the student's answer sheets showed that there were still several experienced students planning the solution.

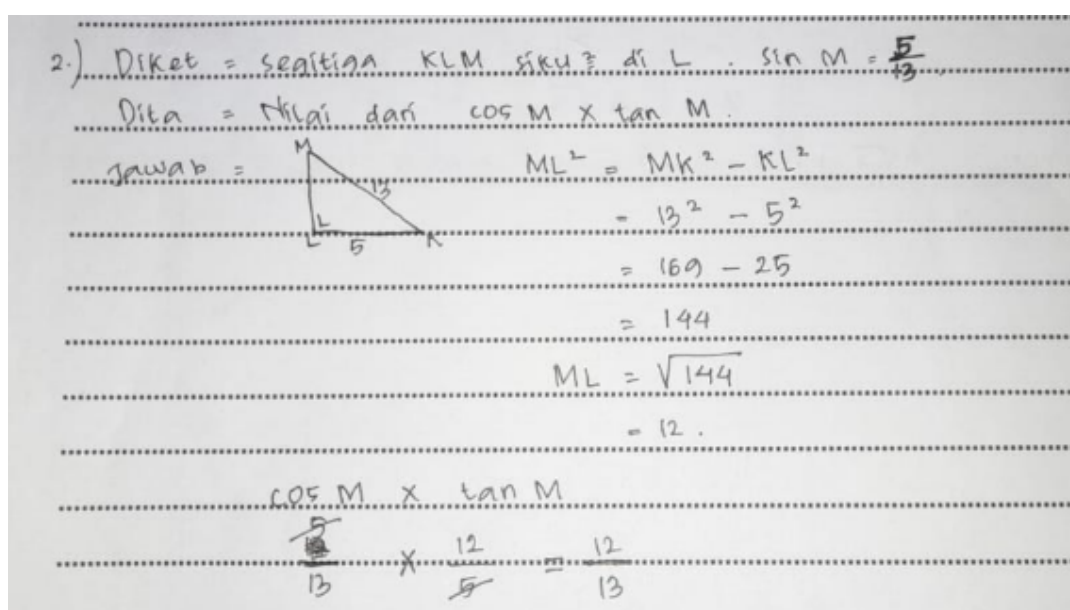
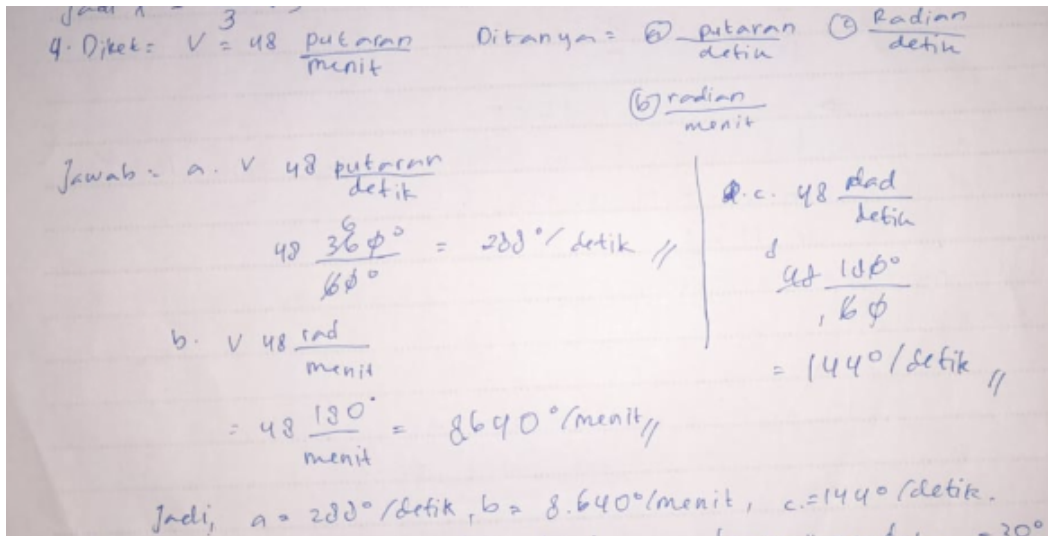


Figure 2. Student's difficulties in planning the solution

From Figure 2, the student could understand the information from the test items, but they did not write the planning of the solution well. It was caused they did not quite understand the formulas of trigonometry.

The stage of carrying out planning solution

The difficulties experienced in this case, students were able to write down all the things related to the questions and plan the solution. Still, they made mistakes in answering the test item.



Diket: $v = 48 \frac{\text{putaran}}{\text{menit}}$ Ditanya: a) $\frac{\text{putaran}}{\text{detik}}$ b) $\frac{\text{radian}}{\text{menit}}$ c) $\frac{\text{Radian}}{\text{detik}}$
 Jawab: a. $v = 48 \frac{\text{putaran}}{\text{detik}}$
 $48 \frac{360^\circ}{60} = 288^\circ/\text{detik} //$
 b. $v = 48 \frac{\text{rad}}{\text{menit}}$
 $= 48 \frac{180^\circ}{\text{menit}} = 8640^\circ/\text{menit} //$
 c. $48 \frac{\text{rad}}{\text{detik}}$
 $\frac{48 \cdot 180^\circ}{60}$
 $= 144^\circ/\text{detik} //$
 Jadi, a = $288^\circ/\text{detik}$, b = $8.640^\circ/\text{menit}$, c = $144^\circ/\text{detik}$.

Figure 3. Student's difficulties in carrying out the planning solution

Based on the student's answer in Figure 3, the mistake they experienced by them was in the stage of carrying out the planning solution. They have difficulty understanding the question and make mistakes in compelling the questions. From here, it is obvious that the answer in points (a), (b), and (c) were not appropriate with the questions. The question in point (a) was round / second, but the answer was degree/ second. (b) the question was radiant/ second, but the answer was degree/ second, and point (c) did not match the question. The question in point (a) was round / second, but the answer was degree/ second. (b) the question was radiant/ second, but the answer was degree/ second, and in point (c) the question was radiant/second, but the answer was degree/second. Based on the test analysis and the analysis of students' interviews, the student's difficulties in carrying out the panning solution were caused by: (1) Students not understanding the questions, (2) Students were not careful in understanding the questions. (3) Students were careless in completing the answer.

The stage of Re-checking the answer

The difficulty in re-checking is the difficulty in reviewing the finishing steps. It is appropriate with the Polya method in the last step, re-checking the solution. Several students failed in this stage because they thought they had found the answer without reviewing whether it was right or wrong. For this reason, it was needed by the students to be accustomed to re-check the answer to avoid any mistakes, so this stage was badly important to do. The following example shows the difficulty of re-checking the answer.

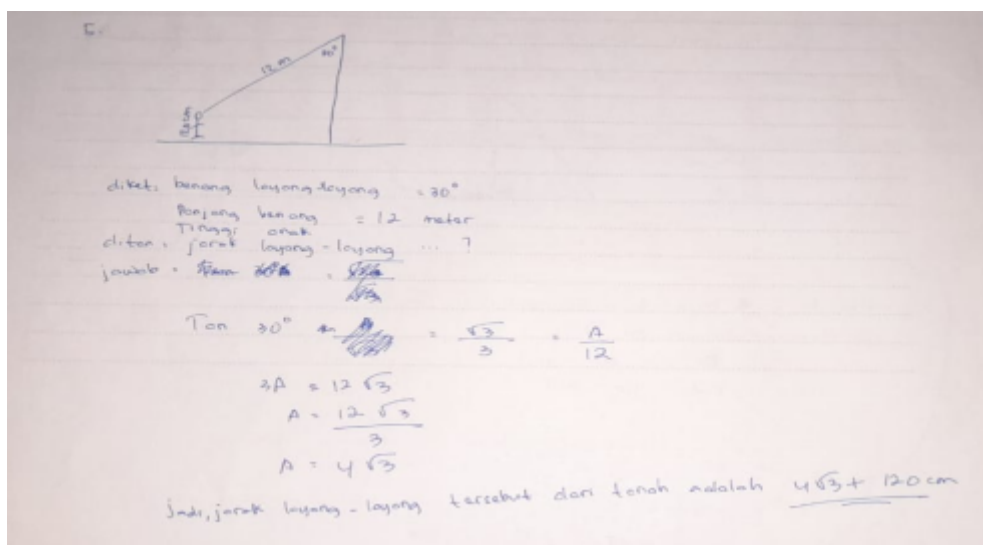


Figure 4. Student's difficulties in re-checking the solution

Based on the answer in Figure 4, in the step of Re-checking the solution where students faced difficulty in solving this problem. The student was in a hurry when working on the problem; in the end, the problem stayed unresolved. The correct answer should be 7.2 meters. Lacking an understanding of trigonometry material was the basic reason for having such a problem.

The difficulties found in this stage were caused by: (1) Students were still confused in solving problems, (2) Students were in a hurry to find the test's answer, (3) The students did not understand the theory as well as the concept.

The difficulties in these steps were following the research done by Pratama, et.al (2015) and Iswara & Setyawan (2022), which stated that problem-solving skills are very important, besides understanding the problem is also important so that they lead to the solution of the problems. The main obstacle for students in solving the problems is they were hesitant to re-checking the answer. Their limitation was that they only focused on how the teacher taught, but they did not develop how to solve the problem by themselves.

CONCLUSION

From the result of the research and discussion, it can be concluded that the difficulties experienced by the students in solving the problems based on Polya's steps can be seen from four steps: understanding the problems, planning solutions, carrying out the planning solution as well as re-checking the solution. According to these steps, it was found that the students had difficulties in problem-solving. These include difficulty understanding the sentences (picture) or terms containing the questions. Consequently, they were confused in writing down what was known and asked. The students could understand the information from the questions, but this happened because they did not understand the formulas in trigonometry. In the planning solution stage, the students struggled to understand the mathematics concept. They did the test in a hurry and did not get used to re-check whether their answer was right or wrong. Based on the result of the study, the researcher suggests to the teachers or the teacher-to-be that they should understand students' difficulties in related materials when involved in the teaching and learning process. In addition, teachers must get used to the students applying Polya's steps to lead the students to gain the ability to solve the problem well.

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