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Mathematical Problem-Solving Ability of Class X Students SMAN 5 Serang City in Completing Story Problems

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Abstrak

Problem-solving ability is one of the goals of learning mathematics and is demonstrated by the ability to understand the problems that occur, compile a settlement plan, carry out the plan, and review the solutions that have been obtained. This research aims to discover and describe students' mathematical problem-solving abilities in the sub-material Comparison of Trigonometry in Right-Angled Triangles. This type of research is qualitative and uses descriptive methods. The sample used in the study was 46 students from class X MIPA 1. The data collection technique used a problem-solving ability test in the form of two-story questions. The results obtained from this study are the average percentage of achievement indicators of students' mathematical problem-solving abilities. The indicator of understanding the problem is 77.55%, the indicator of compiling a settlement plan is 88.75%, the indicator of carrying out the plan is 96.05%, and the indicator of reviewing is 63.4%. It can be concluded that class X students at SMAN 5 Serang City have high mathematical problem-solving abilities.

Kata Kunci: Mathematical abilities, problem-solving

Introduction

The development of modern technology is based on universal mathematics, which also has an essential role in several other fields and enhances human understanding or thinking. Mathematics is one of the subjects that must be taught to students at every level of the school, from elementary to senior high school (Kamarullah, 2017). The provision of mathematics education aims to equip students with the abilities to solve problems, think logically, think analytically, systematically, critically, and creatively, as well as collaborate, as future provisions that can be applied in social life.

About the importance of problem-solving abilities, the National Council of Teachers of Mathematics (NCTM) stated that to undertake mathematics instruction in schools, teachers must focus on the five mathematical abilities: Problem-solving, Communication, Connection, Reasoning, and Representation. Based on the learning objectives of mathematics above, it is clear that problem-solving abilities are essential to be taught to students. Problem-solving is not limited to using formulas or solving routine problems. However, it also leads to habits related to the needs of students to solve real problems in everyday life and self-development skills.

The industrial revolution influenced several fields, one of which was education. Developments in the industrial revolution era 4.0, or 4IR (the Fourth Industrial Revolution), require education to make adjustments, including applying 21st-century skills. According to the Partnership for the 21st Century (Arsyad, 2021), 21st-century life skills include Creativity, Innovation, Critical Thinking, Problem-Solving, Communication, Collaboration, Life Skills, and Carrier Skills. The 21st-century competencies in the 21st-Century Skills Implementation Handbook (2017) are essential skills for students to learn. In short, 21st-century skill competencies are called 4K or 4C and include Critical Thinking and Problem-Solving Skills; Communication Skills; Creativity and Innovation; and Collaboration.

Ruseffendi (Sumartini, 2016) argues that problem-solving abilities are essential in mathematics, not only for those who will later study or study mathematics but also for those who will apply them in other fields of study and everyday life. NCTM states, "*Problem-solving should be the central focus of the mathematics curriculum*. *As such, it is the primary goal of all mathematics instruction and an integral part of all mathematical activities*". Problem-solving should be the center of learning mathematics because problem-solving is the primary goal of all mathematics learning and is a component of all mathematical activities. Schunk supports the NCTM statement by saying, "*One of the most important types of cognitive processing that often occurs during learning is problem-solving*." The quotation shows that problem-solving is one of the essential aspects of the cognitive processes that occur during learning. This shows that problem-solving is fundamental or essential in learning, especially in science and mathematics (Isro'il & Supriyanto, 2020).

Polya defines problem-solving as overcoming challenges to achieve goals that cannot be achieved immediately. More specifically, Seidouvy (Maulyda, 2020) explains problem-solving as solving story problems, solving non-routine problems, using mathematics in real-world situations or other contexts, and proving, finding, or testing conjectures. According to Seidouvy's interpretation, students' mathematical power will appear to develop as they solve math problems.

Generally, students' mathematical problem-solving abilities are not optimal and tend to be in a low category. Previous research showed that only 6 out of 22 students could solve the questions correctly and adequately (Nugraha & Zanthy, 2014). Relevant to this research, the study's results (Nuryana & Rosyana, 2019) showed that 26.92% of students made misunderstandings, 42.31% of students made transformation errors, 53.85% of students made skills errors, and 80.77% of students made inference errors. So it can be concluded that students' problem-solving abilities at one of the vocational high schools in Cimahi City are still relatively low, and efforts must be made to improve them.

This research aims to describe students' mathematical problem-solving abilities in solving story questions sub-material Comparison of Trigonometry in Right Angle Triangles by looking at indicators according to (Polya, 1973), there are 1) Understanding the problem (*understanding*); 2) Compiling a settlement plan (*planning*); 3) Carrying out the plan (*solving*), and 4) Review (*checking*).

Method

This research uses a descriptive method conducted at SMAN 5 Serang City. The population in this research were all students in class X majoring in Mathematics and Science (MIPA), totaling 270 students

and divided into six classes, class X MIPA 1 through X MIPA 6. At the same time, the sample used in the study was 46 students in class X MIPA 1.

The data collection technique in this study used a problem-solving ability test with two questions in the form of a story, each containing four indicators of problem-solving ability.

After the results of student answers are obtained, scoring is carried out on each ability indicator in each item so that a percentage score per indicator is obtained. The percentage results for each indicator are averaged so that the average ability is obtained. The formula used by researchers (Romika & Amalia, 2014) is as follows:

$$\boldsymbol{P = \frac{f}{N} \times 100\%}$$

Information:

$P =$ Percentage ability indicator

$f =$ Gain score

$N =$ Max score

Table 1. Classification of Capability Indicator Category

Category	Percentage
Very Low	$0\% \leq P < 20\%$
Low	$20\% \leq P < 40\%$
Moderate	$40\% \leq P < 60\%$
High	$60\% \leq P < 80\%$
Very High	$80\% \leq P < 100\%$

(Romika & Amalia, 2014)

Giving a score is also used by researchers in classifying students into three groups: students with high abilities, students with moderate abilities, and students with low abilities (Solaikah et al., 2013).

Table 2. Classification of Student's Ability

Ability Indicator	Gain Score
High	$X \geq 80$
Moderate	$65 < X < 80$
Low	$X \leq 65$

Results and Discussion

a. Data Analysis of Instrument Test Results

For the instrument to accurately state the variable to be measured, the researcher first conducted trials on students outside the sample, 46 students in class X MIPA 2, to determine the level of difficulty, discriminating power, validity, and reliability of the instrument. Based on the analysis findings, the instrument items used are valid and reliable and have good difficulty and discriminatory power.

b. Data Analysis of Research Results

After the scoring process for the tests given to 46 students in class X MIPA 1 on February 16, 2023, at 07.15 – 08.45 WIB, the results obtained were scores that grouped students into three categories. The results of the percentage of student scores can be seen in Table 3 below:

Table 3. Overall Student's Score Percentage Results

Ability Categories	Students Amount	Percentage
High	25	54,3%
Medium	12	26,1%
Low	9	19,6%
Total	46	100%

Based on Table 3, it can be seen that 25 students have high ability (score more than 80), 12 students have moderate ability (score range 66 – 80), and 9 students have low ability (score range 0 – 65). A score is given on each ability indicator so that it describes the ability of students to solve problem-solving questions. The results of the percentage of students' abilities on each indicator are as follows:

Table 4. Percentage of Indicator

Question Item	Indicator of Mathematical Problem-Solving Ability			
	Understanding	Planning	Solving	Checking
1	82,6%	91,3 %	96,4 %	63,8 %

2	72,5%	86,2 %	95,7 %	63%
Average	77,55%	88,75 %	96,05%	63,4 %

Based on Table 4, it can be seen that the checking indicator has the lowest percentage, which means that there are still some students who need to correct their conducting a review (looking back) on solving problems that were previously carried out. In comparison, the indicator with the highest percentage is the indicator of carrying out the plan, which shows that students can solve problems well but still need to be corrected in understanding the problem and making plans to solve the problem. The following is an analysis of student's answers on each indicator of problem-solving ability in working on a given problem.

1. **Indicator of Understanding the Problem**

The indicator of understanding the problem is the first step in solving problems, according to Polya's theory. In this step, students collect information by writing down what is known, what is being asked, and pictures/sketches of the problem. Based on the research data in Table 4, an average of 77.55% is obtained for the indicator of understanding the problem, and this figure is included in the high category (Romika & Amalia, 2014).

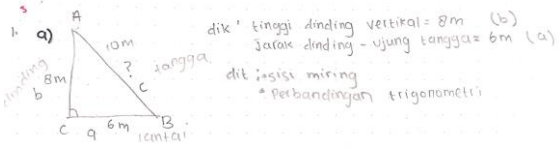

Figure 1. The correct answer, number 1

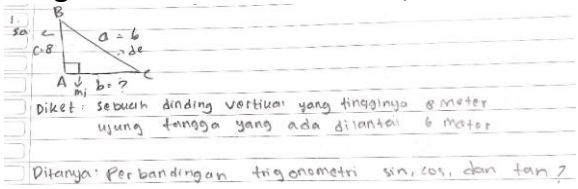

Figure 2. The incorrect answer number 1

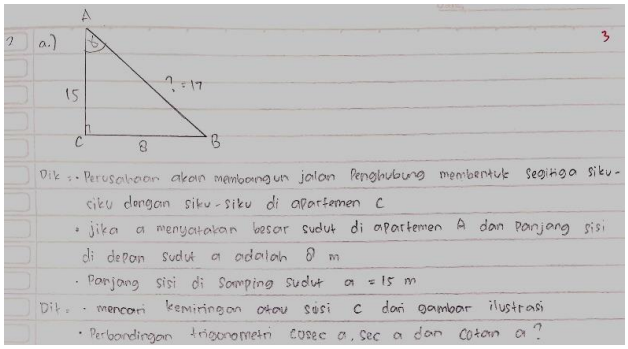

Figure 3. The correct answer, number 2

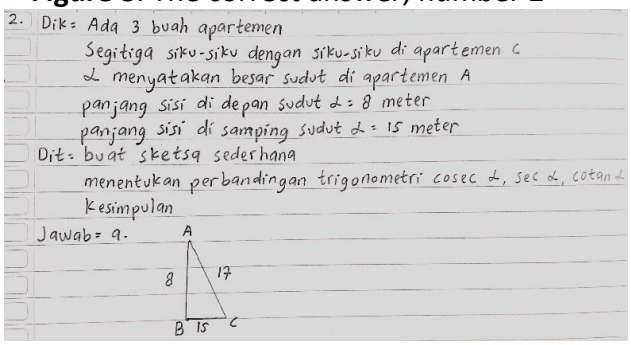

Figure 4. The incorrect answer number 2

Figures 1 and 3 show that students can write information in their language and correctly make mathematical models in graphic illustrations.

Based on Figures 2 and 4, students can write down and collect information in the form of things that are known and asked in their language, but there are mistakes in making illustrations of the problems. Based on what students have written in the known things section, students still need to be corrected in giving names and side lengths to the triangles depicted. In the indicator of understanding the problem, students must pay attention to essential conditions in the problem so that there are no construction errors and the answers produced are correct (Indarwati et al., 2014).

2. **Indicator of Compiling a Settlement Plan**

The indicator of compiling a settlement plan is the second step after understanding the problem. In this step, students estimate the concept/strategy used by applying the material concepts taught before. Based on Table 4, the indicators for compiling plans/strategies obtain an average of 88.75%, where this

figure is included in the very high group (Romika & Amalia, 2014).

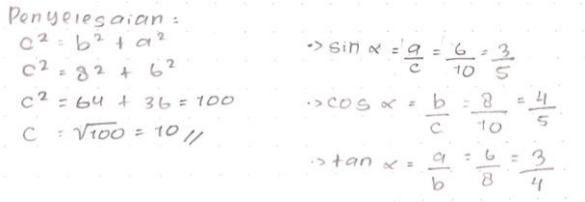

Figure 5. The correct answer, number 1

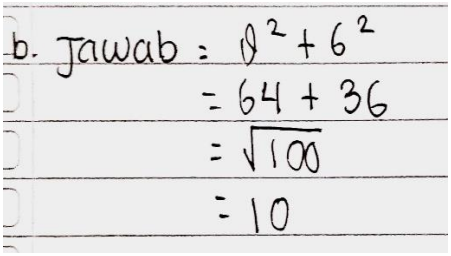

Figure 6. The incorrect answer number 1

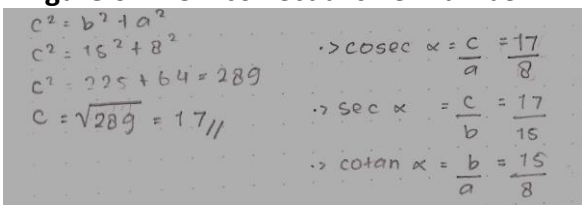

Figure 7. The correct answer, number 2

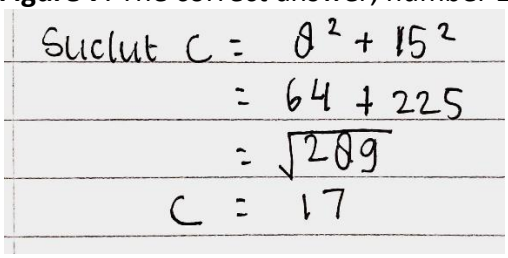

Figure 8. The incorrect answer number 2

Based on Figures 5 and 7, students have determined the completion strategy. However, in Figures 6 and 8, it can be seen that there are students who directly enter the known side length data from the problem without writing down the formulas obtained in the learning process that will be used to solve the problem.

3. Indicator of Carrying Out the Plan

The indicator of carrying out the plan is the third step after understanding the problem and making plans or strategies that have been made. At this step, students enter the data and information obtained, perform calculations, and pay attention to the calculations. Referring to Table 4, the indicator of carrying out the plan obtains an average of 96.05%, which is categorized as very high (Romika & Amalia, 2014). Among other indicators, the indicator of carrying out the plan is the one with the highest average percentage. Almost all students can enter the data or information obtained and pay attention to the steps of the calculation correctly in carrying out the plans or strategies that have been made before.

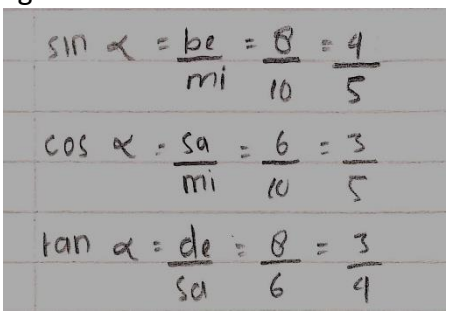

Figure 9. The incorrect answer number 1

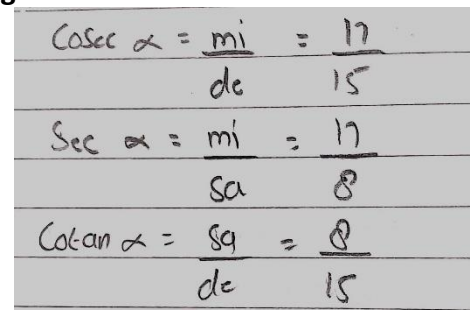

Figure 10. The incorrect answer number 2

Based on Figures 9 and 10, students have been able to determine the solution strategy that will be used, but they entered the data obtained from the problem incorrectly, so the calculations they carried out needed to be corrected.

4. Indicator of Review

The final indicator in the problem-solving step, according to Polya's theory, is a review of the correctness of the solution. In this step, students review their understanding of the problem, solving strategies, and solving solutions to minimize and even avoid mistakes so that they can be corrected. Table 4 research data shows that the review indicator averages 63.4% in the high category (Romika & Amalia, 2014). Among other indicators, the review indicator has the lowest average percentage. It means many students make mistakes when checking back. This is relevant to previous research, which places the review indicator as the lowest, with an

average percentage of 42% (Kurniawan et al., 2019).

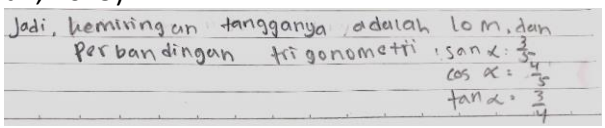

Figure 11. The correct answer, number 1

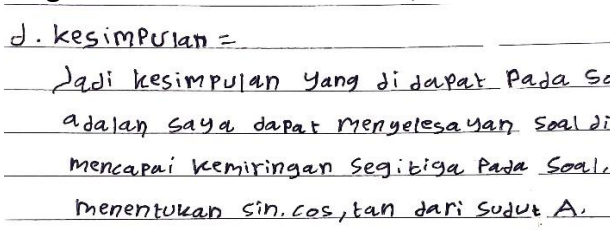

Figure 12. The incorrect answer number 1

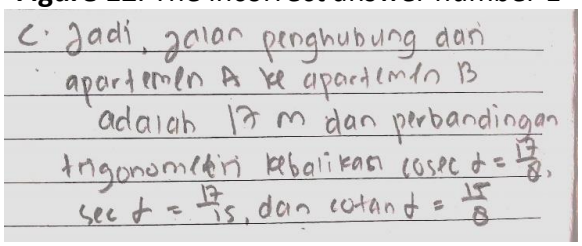

Figure 13. The correct answer, number 2

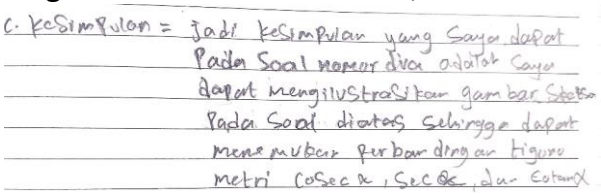

Figure 14. The incorrect answer number 2

Figures 11 and 13 show that students have rechecked against the completion plan that was previously carried out. Students can write down answers by providing satisfactory conclusions on the correct solution to the problem and paying attention to the length unit size. Thus, students can be declared to have reviewed the steps taken.

In Figures 12 and 14, it can be seen that there were students who made mistakes in conducting the review. The student wrote down what he got based on previous calculations but not in the form of answers or sentences.

Conclusion

Based on the results of the research and discussion above, it can be concluded that the mathematical problem-solving ability of class X students in SMAN 5 Serang City in solving story questions in the sub-material Comparison of Trigonometry in Right-Angled Triangles is classified as high, with an average value of 79.15. The indicator of understanding the problem obtains an average percentage of 77.55%, the indicator of compiling a settlement plan obtains an average percentage of 88.75%, the indicator of carrying out the plan obtains an average percentage of 96.05%, and the indicator of reviewing has an average percentage of 63.4%. Students have understood the problem and written down the information obtained using their language, but some students need to correct it when describing the problem illustration. Students have also been able to determine the settlement strategy that will be used and is also able to carry out plans according to the strategy; based on research results, the indicator of carrying out the plan is the one with the highest average percentage. Almost all students have reviewed the solutions obtained by paying attention to unit size. However, there are not a few students who have not been able to or are still incorrect in carrying out the rechecking steps, so this indicator is the lowest average percentage indicator.

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