



Analysis of Students' Mathematical Problem Solving Ability Based on Learning Interest

Novi Wulandari Purba^{a,*}, Rusi Ulfa Hasanah^a

^a *Mathematics Education, Universitas Islam Negeri Sumatera Utara, Medan, 20235, Indonesia*

* *E-mail address: noviiwlp1411@gmail.com*

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Abstract

This research aimed to describe the ability to solve mathematical problems based on learning interests. The method used in this research was qualitative descriptive research. The research subjects were class XI MIA 1 SMA Kartika 1-4 Pematang Siantar students. The selection of research subjects used a purposive sampling technique. The research instruments in this study were learning interest questionnaires, tests of mathematical problem solving abilities and interview guidelines. The data analysis technique used in this study was data reduction, data presentation, and drawing conclusions. The results show that subject student S30 with high learning interest can fulfill all indicators of mathematical problem solving abilities, including understanding problems, making solving plans, doing calculations, and re-checking the results obtained. Subject student S18 with moderate learning interest can fulfill the four indicators of problem solving ability, but the student is less able to plan problem solving, implement plans, and re-examine the results obtained. Subject student S2 with low learning interest can only meet the indicators of understanding the problem.

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1. Introduction

Mathematics has an important role in all aspects of life, especially in improving human thinking power, so that mathematics is one of the subjects that is required at every level of school starting from elementary, junior school, high school and even to college level (Sumartini, 2018). Mathematics plays a key role as the foundation for various other disciplines, because there is a close relationship between mathematics and other sciences, as well as support for technological developments. One of the functions of the mathematics subject itself is as a tool for solving problems both in other subjects, in the world of work, and in everyday life (A'yuni & Pujiastuti, 2021).

Learning mathematics at the school level is not only aimed at increasing students' abilities in counting or applying formulas in solving routine questions, but also at increasing students' abilities in problem solving, both mathematical problems and other problems that use mathematics to solve them (Yarmayani, 2016). It cannot be denied that the ability of students to solve mathematical problems plays an important role in student life, especially as a provision to face the era of globalization in the future. By learning to solve mathematical problems, students will be more analytical in making decisions in their lives (Karim & Arifin, 2022). Therefore the ability to solve mathematical problems is one of the qualifications that must be achieved in learning mathematics (Hermaini & Nurdin, 2020).

According to NCTM, problem solving is a solution that has not been known before by way of assignment so students must describe knowledge, and develop a new understanding of mathematics (NCTM, 2000). Meanwhile, according to Polya, problem solving is an effort to find a way out of a difficulty in order to achieve a goal that is not so easy to achieve immediately (Polya, 1973). So it can be concluded that the ability to solve problems is the ability to find, process information, and find effective solutions to solve the problem.

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According to NCTM, there are five process standards that students must have in learning mathematics, namely problem solving abilities, reasoning and proof skills, communication skills, connecting abilities, and representational abilities (NCTM, 2000). Mathematical problem solving abilities are measured using several indicators. According to Sadiq, indicators of problem-solving ability are understanding the problem, planning how to solve it, implementing the plan and interpreting the results (Sadiq, 2004). Problem solving abilities are reviewed based on the problem solving steps proposed by Polya, namely: understanding the problem, planning problem solving, implementing a problem solving plan, and re-examining the results obtained (Polya, 1973).

Mathematical problem solving ability is a very important competency for students to master (Anggraini et al., 2022). However, students' problem solving abilities in learning mathematics are still not well trained, and there are various levels of difficulty experienced by students in learning mathematics. Factors that can affect problem solving abilities include interest in learning (Afriyati et al., 2019). Interest is a preference and a sense of attachment to something or activity, without being told (Slameto, 2003). Interest is basically the acceptance of a relationship between oneself and something outside oneself. The stronger or closer the relationship, the greater the interest (Pratiwi, 2017). Meanwhile, according to Iskandar interest in learning is the driving force from within the individual to carry out learning activities to increase knowledge and skills and experience (Iskandar, 2012). This interest grows because of the desire to know and understand something to encourage and direct students' interest in learning so that they are more serious in learning (P., 2019). So it can be concluded that interest in learning is the energy and strength that encourages a person to achieve learning goals and interest can occur because of an attitude of pleasure in something. Indicators of interest in learning are feelings of pleasure, interest in learning, awareness of learning without prompting, showing attention while studying, involvement in learning (Friantini & Winata, 2019). Then students' interest in learning can be categorized into classifications of high interest, moderate interest and low interest (Septiani et al., 2020).

Based on the description that has been described above, the researcher is interested in conducting research with the title "Analysis of Students' Mathematical Problem Solving Ability Based on Learning Interest". The purpose of this study was to describe students' mathematical problem solving abilities from the point of view of learning interest with a focus on material derived from algebraic functions.

2. Methods

The method used in this research was qualitative research with a descriptive approach. The school where the research took place was SMA Kartika 1-4 Pematang Siantar. The subjects of this study were students of class XI MIA 1 SMA Kartika 1-4 Pematang Siantar, totaling 32 students. The instruments used were problem solving ability tests, interest in learning questionnaires and interview guidelines. Test questions were given to explore students' problem-solving abilities. Questionnaires were given to classify student interests. As well as interviews were used to dig deeper information to complement the information obtained from tests and questionnaires.

The learning interest questionnaire that the researcher used consisted of 15 statements including 10 positive statements and 5 negative statements which were made based on indicators of student interest in learning, namely feelings of pleasure, interest in learning, awareness of learning without prompting, showing attention while studying and involvement in learning. And 5 problem-solving ability test questions from material derived from algebraic functions. The questions used in this study are as follows.

- (1) There are 2 functions known $f(x)$ and $g(x)$ that is $f(x) = ax^2 + 3x - 2$ and $g(x) = 2x^2 + ax + 4$. The two functions are related to each other $h(x)$ and $k(x)$ shown in $h(x) = f(x) + g(x)$ and $k(x) = f(x) \cdot g(x)$. If known $h'(0) = -4$, determine the value of $k'(0)$! As well as prove that the answers obtained are correct.
- (2) There are 2 functions known $f(x)$ and $g(x)$ that is $f(x) = ax^2 + 4x + 2$ and $g(x) = x^2 + ax - 4$. The two functions are related to each other $h(x)$, Where $h'(x) = \frac{f'(x) \cdot g(x) - f(x) \cdot g'(x)}{g^2(x)}$ is the first derivative of $h(x)$. If known $h'(0) = 2$, determine the value of a ! As well as prove that the answers obtained are correct.
- (3) An army clothing manufacturer manufactures x pairs of clothes per day. To produce these clothes required costs $(x^3 - 90x^2 + 2.700x)$ rupiahs per day. If you want to make these clothes, then

determine the number of clothes that the company must produce in 1 day so that costs are minimized! As well as prove that the answers obtained are correct.

- (4) Mr. Mahmud wants to build a multi-purpose building at SMA Kartika 1-4 which will be used as a center for student activities and school events. However, the multi-purpose building construction project can be completed in x days, by spending a project cost of Rp $\left(2x - 400 + \frac{30.000}{x}\right)$ hundred thousand rupiahs. In order to minimize the cost of this multi-purpose building project, the project can be completed in how many weeks? As well as prove that the answers obtained are correct.
- (5) Army soldiers conduct shooting exercises in an area free of civilians. Then one of the soldiers tries to shoot the bullet upwards, so that the height of the bullet at time t seconds is defined by $h(t) = 24t - 3t^2$ (in meters). Then what is the maximum height that can be traveled by the bullet? As well as prove that the answers obtained are correct.

Data from the analysis results of problem solving ability tests can be grouped into problem solving ability levels with very good, good and poor ability levels based on the following criteria.

Table 1. Problem Solving Ability Category

Scores' Interval	Criteria
$X \geq 80$	Very Good
$65 < X < 80$	Good
$X \leq 65$	Less

(Nurvela et al., 2020)

After the questionnaire and test questions have been distributed to the research class, then an analysis of students' mathematical problem solving abilities is carried out based on learning interest. By using a purposive sampling technique, 1 student was selected from each interest category to conduct interviews including 1 student in the high learning interest category, 1 student in the medium learning interest category, and 1 student in the low learning interest category.

The data analysis techniques used were data reduction, presentation (exposure), verification (conclusion). Data reduction is a selection process, focusing attention on simplifying, abstracting and transforming raw data that emerges from written records in the field (Rijali, 2019). Data reduction leads to the process of selecting, focusing, simplifying, and transforming the raw data written on field notes followed by recording. The data reduction stage in this study includes.

- (1) Correcting the student interest questionnaire which is then grouped into three types of student interest and the results of students' mathematical problem solving ability tests to determine students who will be used as research subjects.
- (2) The results of students' learning interest questionnaires and tests of students' mathematical problem solving abilities which will be used as research subjects which are raw data transformed into notes as material for interviews.
- (3) The results of the interviews were simplified into a good and neat arrangement of language which was then processed to become data that was ready for use.

The presentation of the data in this study presents the results of the formative tests and the results of the interviews in a brief description in the form of a narrative. The collected data will then be grouped based on indicators of the mathematical problem solving ability of each subject. The data presented is in the form of questionnaire results of students' learning interest and tests of students' problem solving abilities, interview results, and data analysis results.

According to Sugiyono (2009), the expected conclusions in qualitative research are new findings that have never existed before or are in the form of a description of an object that was previously unclear so that after research it becomes clear. This conclusion is still a hypothesis, and can become a theory if supported by other data. This is because the problems and problem formulations in qualitative research are temporary and will develop after research in the field. So that in this study drawing conclusions based on data presentation with the aim of obtaining conclusions about students' mathematical problem solving abilities based on learning interest.

3. Results & Discussions

The results of learning interest questionnaire and tests of students' problem solving abilities which have been categorized based on each level are presented respectively in Tables 1 and 2.

Table 2. Recapitulation of student learning interest categories

Interest Categories	Number of Students	Percentage
High	10	31.2%.
Moderate	17	53.1%
Low	5	15.6%

Table 2 shows that the learning interest of class XI MIPA 1 SMA Kartika 1-4 Pematang Siantar is mostly in the medium category with a percentage of 53.1% and the lowest is in the low interest category, namely 15.6% while high interest is 31.2 %.

Table 3. Recapitulation of student problem solving ability categories

Problem Solving Ability Category	Number of Students	Percentage	Average Scores
High	5	15.6%.	85.2
Moderate	1	3.1%	72
Low	26	81.25%	21.4

Table 3 shows that the problem solving abilities of class XI MIPA 1 SMA Kartika 1-4 Pematang Siantar are mostly in the low category with a percentage of 81.25% and the lowest is in the medium problem solving ability category which is 3.1% while the high problem solving ability is 15.6%.

3.1. Mathematical Problem Solving Ability in Terms of High Learning Interest

Based on the results of data collection during the study, there were 10 students who had a high interest in learning with an average score of 65.8 in the good category. For question number 1, 8 students were able to fulfill the indicators of understanding the problem, while the other 2 students were less able. On the indicators of planning problem solving and implementing plans, 10 students were able to fulfill both indicators. And the last indicator checks again, 6 students have been able to fulfill it while 4 other students have not been able to.

For question number 2, 6 students were able to fulfill the indicators of understanding the problem while the other 4 students were less able. Indicators of planning problem solving and carrying out plans, 10 students have been able to fulfill both indicators. And the last indicator checks again, 6 students have been able to fulfill it while 4 other students have not been able to.

For question number 3, 6 students were able to fulfill the indicators of understanding the problem while the other 4 students were less able. Indicators of planning problem solving, 7 students have been able to fulfill it and 4 students have not been able to fulfill it. Indicators of carrying out the plan, 7 students have been able to fulfill it while 3 other students have not been able to fulfill it. And the last indicator checks again, 4 students have been able to fulfill it, but 6 other students have not been able to.

For question number 4, 9 students were able to fulfill the indicator of understanding the problem while 1 other student was not able to fulfill it. Indicators of planning problem solving, 6 students were able to fulfill it and 4 other students were unable. Indicators of carrying out the plan, 6 students have been able to fulfill it, while 4 other students have not been able to. And the last indicator checks again, only 1 student is able to fulfill it and 9 other students are not.

For question number 5, 1 student was able to fulfill the indicator of understanding the problem, 8 students did not fulfill it, and 1 other student did not fulfill it. Indicators of planning problem solving, 6 students have fulfilled it while 4 other students are unable. Indicators of carrying out the plan, 6 students were able to fulfill it and 4 students were unable. And the last indicator checks again, 6 students are able to fulfill it while 4 other students are unable.

One of the research subjects with a high learning interest and problem-solving ability was in the very good category and earned a score of 92, namely S30 students. Here's an analysis of the S30's troubleshooting capabilities.

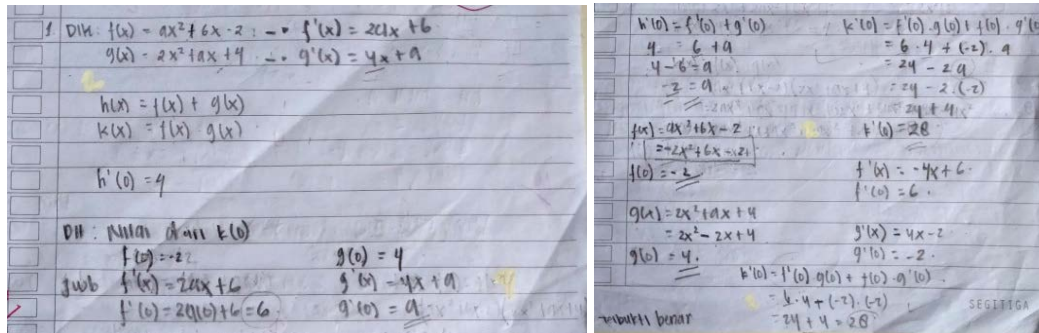


Figure 1. S30's answer sheet question number 1

The answer in Figure 1 shows that S30 is able to understand the problem by writing down what is known, namely the value of the function $f(x) = ax^2 + 6x - 2$, $g(x) = 2x^2 + ax + 4$, $h(x) = f(x) + g(x)$, $k(x) = f(x) \cdot g(x)$ and value $h'(0) = 4$. Then write down the things that are asked of the problem, namely the value of $k'(0)$. S30 is also able to plan problem solving by writing formulas $k'(0) = f'(0) \cdot g(0) + f(0) \cdot g'(0)$. Furthermore, S30 is able to carry out the plan according to the previously written formula. S30 is also able to check again by proving the answers obtained are correct.

Based on the results of the interview on question number 1, S30 was able to understand the problem by mentioning the information that was known and asked in full. S30 is also capable of creating a problem-solving plan by stating the correct formula. Then, S30 is able to carry out the plan until the right solution is obtained. Furthermore, S30 was able to re-examine by proving the answers obtained were correct. Data from the analysis of written tests and interviews shows that S30 is able to understand problems, is able to plan problem solving, is able to carry out plans and is able to re-examine.

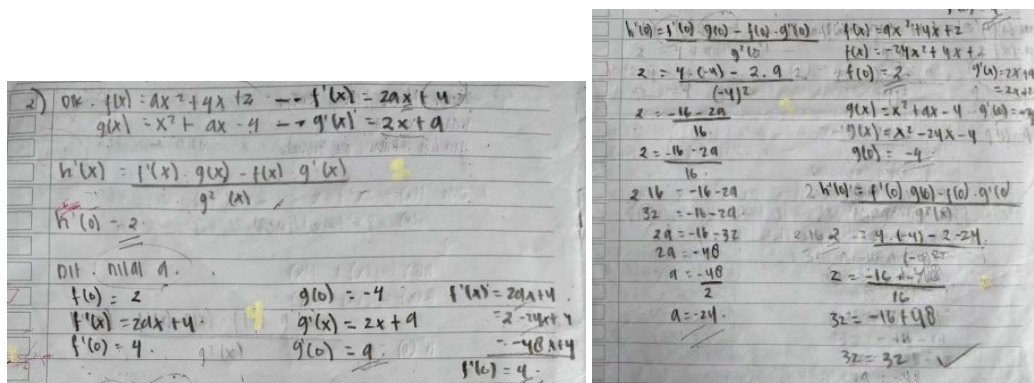


Figure 2. S30's answer sheet question number 2

The answer in figure 2 shows that the S30 is able to understand the problem by writing down the value $f(x) = ax^2 + 4x + 2$, $g(x) = x^2 + ax - 4$, $h'(x) = \frac{f'(x) \cdot g(x) - f(x) \cdot g'(x)}{g^2(x)}$ and $h'(0) = 2$. Then write down the things that are asked of the problem, namely determining the value a . S30 is also able to plan problem solving by writing down the strategy to be used, namely $h'(0) = \frac{f'(0) \cdot g(0) - f(0) \cdot g'(0)}{g^2(0)}$. Furthermore, the S30 was able to carry out the plan according to the plan previously written. S30 is also able to check again by proving the answers obtained are correct.

Based on the results of the interview on question number 2, S30 was able to understand the problem by mentioning the information that was known and asked in full. S30 is also capable of creating a problem-solving plan by stating the correct formula. S30 is able to carry out the plan until the right result is obtained. Furthermore, S30 was able to check again by proving the answers obtained were correct. Data from the

analysis of written tests and interviews shows that S30 is able to understand problems, is able to plan problem solving, is able to carry out plans and is able to re-examine.

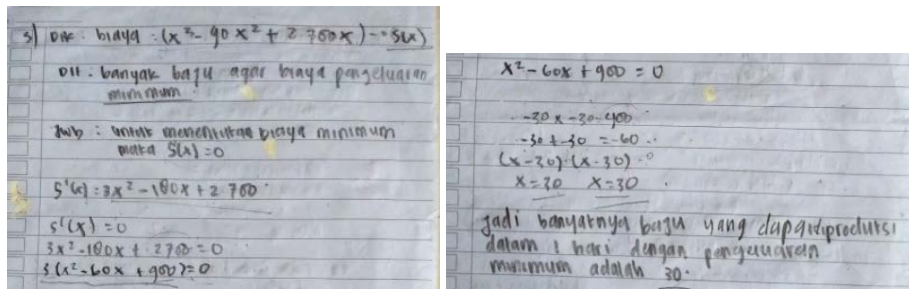


Figure 3. S30’s answer sheet question number 3

The answer in Figure 3 shows that S30 is able to understand the problem by writing down what is known, namely the cost of producing clothes ($x^3 - 90x^2 + 2.700x$). Then S30 wrote down the things that were asked of the problem, namely lots of clothes so that spending costs were minimal. S30 is also able to plan problem solving by explaining the strategy used, namely to determine the minimum cost then $S'(x) = 0$. Furthermore, S30 was able to carry out the plan according to the plan previously written. But S30 was unable to re-examine it by not proving the answers it got were correct.

Based on the results of the interview on question number 3, S30 was able to understand the problem by mentioning the information that was known and asked in full. S30 is also capable of creating a problem-solving plan by stating the correct formula. Then, S30 is also able to carry out the plan until the right solution is obtained. Furthermore, S30 was able to check again by proving the answers obtained were correct. Data from the analysis of written tests and interviews show that S30 is able to understand problems, is able to plan problem solving, is able to carry out plans and is less able to re-examine.

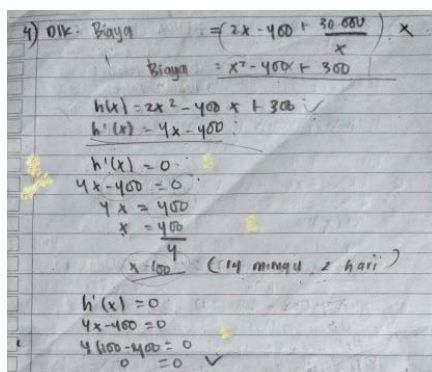


Figure 4. S30’s answer sheet question number 4

The answer in Figure 4 shows that S30 is able to understand the problem by writing down what is known, namely the project cost of $(2x - 400 + \frac{30.000}{x})$. However, S30 did not write down what was asked of the problem, namely the timeframe that could be completed so that the cost of the development project was minimized. S30 is able to plan problem solving by writing down $h'(x) = 0$. Furthermore, S30 is able to carry out the plan in accordance with the plan previously written. S30 is also able to check again by proving the answers obtained are correct.

Based on the interview results, S30 was able to understand the problem by mentioning the information that was known and asked in full. S30 is also able to make a problem solving plan by mentioning the right elements. Then, S30 is also able to carry out the plan until the right solution is obtained. Furthermore, S30 was able to re-examine by proving the answers obtained were correct. Data from the analysis of written tests and interviews shows that S30 is able to understand problems, is able to plan problem solving, is able to carry out plans and is able to re-examine.

$h(t) = 24t - 3t^2$ → $h' = 24 - 6t$ $h(4) = 24(4) - 3(4)^2$
 Dit: tinggi maksimum $h'(t) = 24 - 6t = 0$
 sub: untuk menentukan tinggi maksimum
 Maka $h'(t) = 0$
 $h'(t) = 0$ $t = 4$ disubstitusikan
 $24 - 6t = 0$ ke dalam fungsi $h(t)$
 $24 = 6t$ $h(4) = 24(4) - 3(4)^2$
 $t = 24$ $= 96 - 48$
 6 $= 48$
 $t = 4$ $h'(t) = 0$ $0 = 0$
 $24 - 6t = 0$
 $24 - 6(4) = 0$

Figure 5. S30's answer sheet question number 5

The answer in Figure 5 shows that S30 is able to understand the problem by writing down what is known, namely $h(t) = 24t - 3t^2$ and write down the thing that is asked of the problem, namely the maximum height. S30 is able to plan problem solving by writing down to determine the maximum height then $h'(t) = 0$. Furthermore, S30 is able to carry out the plan in accordance with the plan previously written. S30 is also able to check again by proving the answers obtained are correct.

Based on the interview results, S30 was able to understand the problem by mentioning the information that was known and asked in full. S30 is also able to make a problem solving plan by mentioning the right elements. Then, S30 is able to carry out the plan until the right solution is obtained. Furthermore, S30 was able to re-examine by proving the answers obtained were correct. Data from the analysis of written tests and interviews shows that S30 is able to understand problems, is able to plan problem solving, is able to carry out plans and is able to re-examine.

3.2. Mathematical Problem Solving Ability in Terms of Moderate Learning Interest

Based on the results of data collection during the study, there were 17 students who had moderate interest in learning with an average test score of 20.3 in the less category. For question number 1, 15 students were able to fulfill the indicators of understanding the problem while 2 students were less able. Indicators of planning problem solving, 11 students have fulfilled, 4 students are less able and 2 students are unable. The indicators of carrying out the plan, 10 students have been able to fulfill, 4 are less able, and 3 students are unable. And the last indicator checks again, 5 students are able to fulfill it while 12 other students are not able to fulfill it.

For question number 2, 7 students were able to meet the indicators of understanding the problem, 1 student was less able and 9 were unable. Indicators of planning problem solving, 11 students have been able to fulfill, 4 students are less able and 2 students are unable. The indicators of carrying out the plan, 2 students have been able to fulfill it while 15 students have not been able to. And the last indicator to check again, 17 students are not able to meet these indicators.

For question number 3, 5 students were able to meet the indicators of understanding the problem, 3 students were less able and 9 students were unable. Indicators of planning problem solving, 2 students were able to fulfill it and 15 students were unable. Indicators of carrying out the plan, 2 students have been able to fulfill it and 15 students have not been able to fulfill it. And the last indicator checks again, 1 student is able to fulfill it and 16 students are not able to fulfill it.

For question number 4, 5 students did not meet the indicator of understanding the problem and 12 students were unable to fulfill it. Indicators of planning problem solving, 2 students have fulfilled it and 15 students are not able to fulfill it. Indicators of carrying out the plan, 2 students have been able to fulfill it and 15 students have not been able to fulfill it. And the last indicator to check again, 17 students are not able to meet these indicators. For question number 5, 2 students have fulfilled the indicator of understanding the problem, 1 does not fulfill it and 14 does not fulfill it. On the indicators of planning problem solving, carrying out plans, and checking again 17 students were unable to fulfill the three indicators.

One of the research subjects with moderate interest in learning and problem-solving skills in the less category who obtained a score of 44, namely S18 students. The following is an analysis of S18's problem solving abilities.

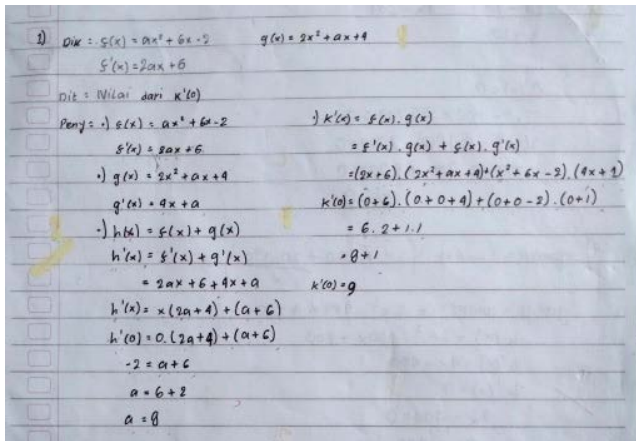


Figure 6. S18's answer sheet question number 1

The answer in Figure 6 shows that S18 is less able to understand the problem by writing down what is known, namely the function $f(x) = ax^2 + 6x - 2$, $g(x) = 2x^2 + ax + 4$ but not write down the value $h(x) = f(x) + g(x)$, $k(x) = f(x) \cdot g(x)$ and $h'(0) = 4$. Then, S30 writes down what is being asked of the problem, namely the value of $k'(0)$. S18 is less able to plan problem solving because the formula used is wrong. Furthermore, S18 is also less able to carry out the solution, it can be seen that the calculations written are wrong. S18 was unable to recheck the troubleshooting steps performed.

Based on the results of the interview, S18 was able to understand the problem by stating the information that was known and asked in full. However, S18 is less able to make a problem solving plan by mentioning the wrong formula. Meanwhile, S18 was also unable to carry out the settlement because it made the wrong calculation. Furthermore, S18 was also unable to re-examine because he could not prove the answers he got were correct. Data from written test and interview analysis showed that S18 was able to understand problems, was unable to plan problem solving, was unable to plan problem solving, was unable to carry out plans and was unable to re-examine.

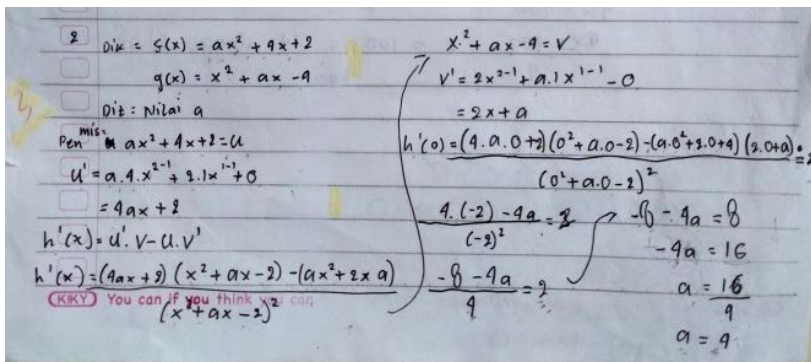


Figure 7. S18's answer sheet question number 2

The answers in Figure 7 show that S18 was less able to understand the problem because the information in the questions written was incomplete. S18 writes down what is asked of the problem, namely determining the value a but what is known in the problem is not complete. Where S18 only writes functions $f(x) = ax^2 + 4x + 2$ and $g(x) = x^2 + ax - 4$ but not writing $h'(x) = \frac{f'(x) \cdot g(x) - f(x) \cdot g'(x)}{g^2(x)}$ and $h'(0) = 2$. S18 is less able to plan problem solving because the formula used is wrong. Furthermore, S18 is also less able to carry out the solution, it can be seen that the calculations written are wrong. And the final stage of S18 is not being able to re-examine the troubleshooting steps that were carried out.

Based on the interview results, S18 was able to understand the problem by stating the information that was known and asked in full. However, S18 was less able to come up with a troubleshooting plan because it mentioned the wrong formula. Meanwhile, S18 was also unable to carry out the settlement because it made the wrong calculation. Furthermore, S18 was also unable to re-examine because he could not prove

the answers he got were correct. Data from the analysis of written tests and interviews showed that S18 was able to understand problems, was unable to plan problem solving, was unable to carry out plans and was unable to re-examine.

Figure 8. S18's answer sheet question number 3

The answer in Figure 8 shows that S18 is less able to understand the problem, S18 writes down what is known, namely $B'(x) = (x^3 - 90x^2 + 2.700x)$ but S18 did not write down the things that were asked of the problem. S30 is able to plan problem solving by writing down the strategy to be used ie $B'(x) = 0$. Furthermore, S18 is able to carry out plans according to plans previously written. S18 is also able to re-examine by proving the answers obtained are correct.

Based on the interview results, S18 was able to understand the problem by stating the information that was known and asked in full. S18 is also able to make a problem solving plan by mentioning the right formula. Then, S18 is able to carry out the plan until the right results are obtained. Furthermore, S18 was able to re-examine by proving the answers obtained were correct. Data from the analysis of written tests and interviews shows that S18 is able to understand problems, is able to plan problem solving, is able to carry out plans and is able to re-examine.

Figure 9. S18's answer sheet question number 4

The answer in Figure 9 shows that S18 is less able to understand the problem, S18 writes down what is known, namely the time period = $(2x - 400 + \frac{30.000}{x})$ but S18 did not write down the things that were asked of the problem. S18 is able to plan problem solving by writing down the strategy to be used, namely $B'(x) = 0$. Furthermore, S18 is able to carry out plans according to plans previously written. However, S18 was unable to re-examine by proving the answers obtained were correct.

Based on the interview results, S18 was able to understand the problem by stating the information that was known and asked in full. S18 is also able to make a problem solving plan by mentioning the right formula. Then, S18 is able to carry out the plan until the right results are obtained. Furthermore, S18 was able to re-examine by proving the answers obtained were correct. Data from the analysis of written tests and interviews shows that S18 is able to understand problems, is able to plan problem solving, is able to carry out plans and is less able to re-examine.

In question number 5 S18 did not answer the problem at all so that it can be said that S18 was unable to understand the problem, unable to plan problem solving, unable to carry out the plan and unable to re-examine. Based on the interview results, S18 was able to understand the problem by stating the information

that was known and asked in full. However, the S18 was unable to come up with a troubleshooting plan. S18 was also unable to carry out the plan and was unable to re-examine by proving the answers obtained were correct. Data from the analysis of written tests and interviews showed that S18 did not understand the problem, was unable to plan problem solving, was unable to carry out the plan and was unable to re-examine.

3.3. Mathematical Problem Solving Ability in Terms of Low Learning Interest

Based on the results of data collection during the study, there were 5 students who had a low interest in learning with an average test score of 10 in the less category. For question number 1, 3 students were able to fulfill the indicator of understanding the problem and 2 students were less able to fulfill it. Indicators of planning problem solving, 2 students have fulfilled, 1 student is less able and 2 students are not able. Indicators of carrying out the plan, 1 student is able to fulfill, 1 is less able and 3 students are unable. And the last indicator checks again, 5 students are able to fulfill these indicators.

For question number 2, 1 student was able to fulfill the indicator of understanding the problem, 4 students did not. In the indicators of planning problem solving, carrying out plans and checking again, 5 students were unable to fulfill the three indicators. For question number 3, 5 students were unable to meet the indicators of understanding the problem and planning problem solving. On the indicator of carrying out the plan, 1 student was unable to fulfill it, and 4 students were unable to fulfill it. And the last indicator checks again, 5 students are not able to meet these indicators. For questions number 4 and 5, 5 students did not meet the indicators of understanding the problem, planning problem solving, carrying out the plan, and checking again because they did not write down the answers at all.

One of the research subjects with low interest in learning and problem-solving skills in the less category who obtained a score of 16, namely S2 students. The following is an analysis of S2's problem solving abilities.

The image shows two pages of handwritten mathematical work. The left page contains the following text:

1. Dik : $f(x) = ax^2 + 6x - 2 \rightarrow f'(x) = 2ax + 6$
 $g(x) = 2x^2 + ax + 4 \rightarrow g'(x) = 4x + a$
 $h(x) = f(x) + g(x)$
 $k(x) = f'(x) \cdot g(x)$
 $h(0) = 4$
 dit : nilai dari $k'(0)$

The right page contains the following calculations:

$f'(0) = 2$
 Sub : $f'(x) = 2ax + 6$
 $f'(0) = 2a(0) + 6 = 6$
 $h'(0) = f'(0) + g'(0)$
 $4 = 6 + a$
 $a - 6 = a$
 $-6 = a$

$g(0) = 4$
 $g'(x) = 4x + a$
 $g'(0) = a$
 $f'(0) \cdot f(0) \cdot g(0) + f(0) \cdot g'(0)$
 $= 6 \cdot 4 + (-2) \cdot a$
 $= 24 - 2a$
 $= 24 - 2 \cdot (-2)$
 $= 24 + 4$
 $= 28$

Figure 10. S2's answer sheet question number 1

The answer in Figure 10 shows that S2 is able to understand the problem by writing down what is known, namely the value of the function $f(x) = ax^2 + 6x - 2$, $g(x) = 2x^2 + ax + 4$, $h(x) = f(x) + g(x)$, $k(x) = f'(x) \cdot g(x)$ and value $h'(0) = 4$. Then write down the things that are asked of the problem, namely the value of $k'(0)$. S2 is able to plan problem solving by writing down the strategy to be used namely $k'(0) = f'(0) \cdot g(0) + f(0) \cdot g'(0)$. Furthermore, S2 is able to carry out the plan according to the formula that has been written before. However, S2 was unable to re-examine by proving the answers obtained were correct.

Based on the interview results, S2 was able to understand the problem by mentioning the information that was known and asked in full. However, S2 was less able to make a problem solving plan because he did not mention the correct formula. Then, S2 is able to carry out the plan until the right results are obtained. Furthermore, S2 was unable to re-examine because he could not prove the answers he got were correct. Data from the analysis of written tests and interviews show that Masters students are able to understand problems, are less able to plan problem solving, are able to carry out plans and are unable to re-examine.

In questions number 2 to 5 S2 does not answer the problem at all so it can be said that S2 is unable to understand the problem, unable to plan problem solving, unable to carry out plans and unable to re-examine. Likewise with the results of the interview questions number 2 to 5 S2 was only able to understand the problem, namely by mentioning the information known and asked in the questions in full, while planning problem solving, carrying out plans and checking again could not be fulfilled. Data from the analysis of written tests and interviews showed that S2 was unable to understand the problem, was unable to plan problem solving, was unable to carry out the plan and was unable to re-examine.

3.4. Discussion

Based on the data analysis conducted by the researcher, it was shown that S30, namely students with high learning interest, were able to fulfill the four steps of problem solving according to Polya well. This is in line with research findings (A'yuni & Pujiastuti, 2021), which states that students who have a high interest in learning are able to fulfill all indicators of mathematical problem solving abilities including understanding problems, planning solutions, solving problems, and checking.

Subjects who have a high interest in learning in this study are able to fully understand the problem by identifying what is known and what is asked in the problem. Then be able to plan problem solving by choosing the right and correct strategy. Furthermore, in carrying out the plan students are able to explain carefully and thoroughly. As for the step of checking again, they were able to do it well, it can be seen from proving that the answers they got were correct. This result is in accordance with the opinion (Anggraini et al., 2022) that the higher the students' interest in learning mathematics, the better their problem-solving abilities.

S18 students with moderate learning interest in solving problems also fulfill the four steps of problem solving according to Polya, but students are less able to plan problem solving, carry out plans, and check again. This is indicated by when given questions, it is still wrong to write down the formula or strategy that will be used first. These results are consistent with research findings (Laila et al., 2021), which states that students with moderate learning interest categories have moderate problem-solving abilities, students can solve problem-solving questions by fulfilling all indicators of problem-solving ability according to polya but some other stages are still less thorough and systematic.

Meanwhile, students with low learning interest were only able to fulfill the problem solving steps, namely understanding the problem. Students have not been able to reach the stage of planning problem solving, carrying out plans and checking again. This is in line with research findings (Nugraha & Basuki, 2021) which states that students who have a low interest in learning mathematics will find it difficult when faced with math problems.

In general, students with high learning interest have better problem-solving abilities, because they enjoy learning and have an interest in learning compared to students with moderate and low learning interest. This is in line with the opinion (Hidayati et al., 2023) that high, medium, and low learning interest greatly influences students' problem-solving abilities in solving math problems.

4. Conclusion

Based on the results of research on the analysis of mathematical problem solving abilities based on students' learning interest, it can be concluded that subject student S30 with high learning abilities interest and a problem solving ability score of 92, a very good category, is able to fulfill all indicators of mathematical problem solving abilities including understanding problems, making solving plans, doing calculations, and check the results again. Subject student S18 with moderate learning interest who has a problem-solving ability score of 44, less category, is able to fulfill the four indicators of problem-solving ability, but the student is less able to plan problem-solving, carry out plans, and re-check the results obtained. Subject student S2 with low learning interest who has a problem solving ability score of 16 in the less category is only able to meet the indicators of understanding the problem.

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