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Students' Mathematical Thinking in Non-routine Mathematical Problems

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Abstract

The goal of this study was to determine the mathematical thinking process of students in class VIII at SMP 3 Bengkulu City when solving non-routine math problems based on Pythagorean theorem material. The research method used in this study is qualitative field research. In the diagnostic tests that have been administered to students, the percentage of data obtained by high-ability students totaling 3 students is 14 percent, students with moderate abilities totaling 7 students are 33 percent, and 11 students with low ability are 53 percent. According to Mason, the flow of the mathematical thinking process by each research subject varies depending on the form of the problem based on the facts presented. Students include the entry, attack, and review phases in problem number one for high school students. Students cover the attack and review phases for moderate students. Students do not meet the phase in the thinking process that students have in low students. Students complete the entry and attack phases in problem number 2 for high school students. Students cover the entry and attack phases for moderate students. Students cover the entry phase for low students.

Keywords: mathematical thinking, students, non-routine mathematics

INTRODUCTION

Education is important in achieving a person's life goals in order to survive in daily life. According to Law No. 20 of the Republic of Indonesia concerning the National Education System (SISIDIKNAS), education is a conscious and planned effort to create a learning environment and learning process in which students actively develop their potential to have religious spiritual strength, self-control, personality intelligence, noble character, and skills required by himself, society, nation, and state.

Students are expected to be able to solve a problem related to learning in everyday life during the learning process. Students are expected to be able to apply their knowledge in other subjects by solving a problem. One of them was conducted in this study to improve mathematics learning. Many students claim that mathematics is a subject that few people enjoy; mathematics lessons are taught from elementary school (SD) to high school. We can improve students' ability to think and argue, contribute to science and technology in solving problems in everyday life in the workplace, and provide support in the development of science and technology by studying mathematics. Students are expected to learn mathematics in order to think logically, analytically, systematically, critically, and creatively, as well as to work collaboratively (Sgela, 2014). Mathematics subjects in a person can recognize and count numbers. Since then, students from PAUD to college have been taught this lesson. The goal of learning mathematics in

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schools is for students to be not only skilled but also to be able to think critically when solving a problem and to provide students with provisions by applying mathematics in everyday life in the community where they live. Students can solve a mathematical problem by thinking about it. Students' thinking processes can be used to solve mathematical problems. That is how students can get ideas and process information by processing data in their brains.

The National Council of Teachers of Mathematics (NCTM) outlines the most important components of a high-quality school mathematics program. Learning mathematics according to NCTM, there are five processes formulated at NCTM, namely problem solving (problem-solving), proof and mathematical reasoning (reasoning and proof), communication of ideas mathematical (communication), connection (connection), and representation (representation) (NCTM, 2000). Based on the five NTCM principles mentioned above, all of the above components demonstrate the importance of students' mathematical thinking skills.

Students must be able to think mathematically; students are expected to get ideas by thinking mathematically, and by thinking mathematically easily, students can easily achieve goals in a mathematics lesson by solving problems. When students are learning, they will solve math problems by engaging in mental activities. To discover mathematical thinking in students, we can trace the mathematical thinking processes that exist in students and are related to student behavior, or we can solve a mathematical problem (Farib dkk., 2019).

Mathematical thinking can also be defined as a way of thinking about mathematical processes (doing math) or thinking about how to complete simple or complex mathematical tasks (Sumarno, 2010). Mathematical thinking in students is also interpreted as synthesizing and utilizing cognitive processes that can lead to a higher level of abstraction (Kinard, 2017). The existence of problem abilities is one of the important descriptions in mathematical thinking that exists in students.

Problem solving is used to find a way out of a difficult situation in order to achieve a difficult goal. Understanding the problem, planning a solution, and re-checking what has been done are the four stages of polya in problem solving in this solution (Ariskari, 2019).

Piaget's theory of learning states that learning must be adapted to the stage of mental development. Piaget's theory is divided into four stages: 1. Sensorimotor stage (age 0-2 years), 2. Operational stage (2-7 years), 3. Concrete operations stage (7-11 years), and 4. Formal operations stage (11 years and over). Environmental adaptation is accomplished through the assimilation and accommodation processes. According to research for junior high school students in the formal operation stage (11 years and up), students are able to think abstractly when faced with a problem.

Students' abilities will be demonstrated by their ability to solve a problem using two types of questions: routine questions and non-routine questions. Routine questions are those that are fixed in the text/book and use the same question form as the teacher. While non-routine questions are those that do not have answers in books, solving them requires more thought because they are not the same as the procedures described in class (Ayuningrum dan Setiawan, 2018).

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Problem-solving students in Indonesia fall into the lowest category when it comes to solving non-routine problems; students have failed to solve non-routine problems. on students' ability to solve a problem encountered frequently in everyday life According to the facts in Indonesia, the results of tests organized by the Program for International Student Assessment (PISA) organized by the Organization for Economic Cooperation and Development (OECD) in 2015, the average score, show a low problem-solving ability. Indonesian students scored 386 points, placing them 62nd out of 69 participating countries. The findings of Indonesia's participation in the Treads in International Mathematics and Science Study back this up (TIMSS). The ability to solve non-routine problems is one of the indicators assessed in TIMSS, and the data is as follows:

Table 1. Indonesian TIMSS Results Data (Islamiah dkk., 2018)

Year	**Average value**	**Rating**	**Number of participants**
1999	403	34	38
2003	411	35	46
2007	397	36	49
2011	386	38	42

The TIMSS standard value is 500. Indonesia remains at the bottom of the four participating countries. This fact demonstrates that Indonesia ranks last in the world when it comes to learning mathematics and problem solving. Routine problems are still used in schools, but students are trained to solve non-routine questions when participating in the Olympics.

Several factors influence the thinking process when solving non-routine problems, including internal factors (internal factors) and external factors (external factors) (external factors). Talent and intelligence, creativity, motivation, interest, and attention are all internal factors. The social environment, physical environment, and learning facilities are examples of external factors. The self-factor is frequently what determines a person's success. If the self-factor is supportive, the related one is more likely to succeed. If the student is serious about learning, the student will attempt to overcome external factors that are less supportive (Supardi, 2015).

According to my internship experience at SMP 3 Bengkulu City, students' mathematics learning is more dominant in solving routine questions from books, and students lack experience in solving non-routine questions that can train students' mathematical thinking processes. According to the findings of interviews with mathematics teachers at SMP 3 Bengkulu City, during the internship period, two students were more able to solve questions based on the teacher than questions not based on the teacher. As long as the teacher asks questions that have been taught during the school day, many students will be unable to answer the routine questions that have been explained by the teacher. Children are still receiving grades that do not meet the KKM during the daily test with routine questions, and when students are given non-routine questions, they are unable to do so. If a non-routine problem is presented, does the student's mathematical thinking process consist solely of problem solving? As a result, this research is required.

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Students who are accustomed to working on non-routine math problems will be accustomed to being trained by applying several mathematical concepts in new situations, so that in the end they will be able to apply various scientific concepts they have learned to solve a problem in everyday life. Giving non-routine questions is one way to help students develop problem-solving skills. It is critical for students to be able to think creatively and generate a desire to motivate themselves when solving a math problem (Mulyati, 2016). So that in solving mathematical problems, the mathematical thinking process can be traced to the stages of Mason's theory to solve a problem, namely entry (aspects of know, want, and introduce), attack (aspects of try, maybe, and why), and review (aspects of try, maybe, and why) (check, reflect, and extended aspects) (Mason et al., 2010) .

Giving students non-routine questions is one way to solve a problem. Non-routine questions are those that require more thought to solve because the procedure is not clear or is not the same as the process learned in class.

Non-routine questions may present new situations that previous students have not encountered. There is a clear goal that students want to achieve in new conditions, but the way to achieve it does not immediately appear in students' minds (Pasandaran, 2019). Students are uneasy when solving mathematical problems, particularly non-routine problems (Arslan dan Altun, 2017).

METHODS

The research conducted is qualitative field research, where the researcher is the key instrument, the data collection technique is carried out in combination, the data analysis is qualitative, and the results of qualitative research emphasize meaning rather than generalization (Sugiyono, 2018). The subjects of this study were class VIII students from SMP N 3 Bengkulu City. The test is given to all students in one class; for thinking process analysts, 5-6 subjects classified as high, medium, and low will be taken; these students will then be given non-routine questions; and 6 students will be chosen for the interview test.

As a form of data collection technique, this study used two tests: test questions and interviews. When direct communication between the investigator and the subject or respondent is required during an interview (Winarni, 2018).

FINDING AND DISCUSSIONS

1. The results of the Mason's theory-based test of students' mathematical thinking processes in solving non-routine mathematical problems.

Based on Mason's theory, this section describes the research data on students' mathematical thinking processes in solving non-routine mathematical problems. Students completed the diagnostic test questions in this data by selecting students who were classified as high, low, and medium, students who have a high classifiable value, namely MFA with a value of 90 and MFR with a value of 85. JS has a moderately classified score of 79, and RZ has a moderately classified score of 79. Students with a low grade have an MRV of 15 and a P of 10.

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By analysing the results of Pythagorean test questions and interviews on research subjects, the mathematical thinking process of students in solving non-routine mathematical problems based on Mason's theory is carried out. The subjects to be studied were chosen based on the students' abilities as determined by diagnostic test questions administered by the researcher. Based on these values, they are divided into three groups: high, medium, and low students.

The first issue is that Sefry has a trapezoidal board. Sefry will paint a portion of it (which is marked in dark brown). Side AE is 10 cm long, the base of the trapezoid is 32 cm long, the height of the trapezoid is twice the height of the triangle, and the two triangles below are 10 cm long:

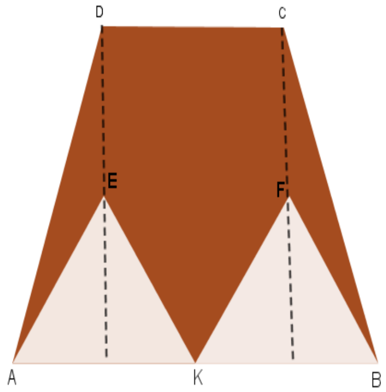

Figure 1. Question number 1

Problem No. 2: A triangular field has an 18-meter perimeter. The second side extends two meters beyond the first. The third side is two meters longer than the first. To prevent animals from entering the field, fence nets will be installed. How much network space is required?

Students are chosen from the picture above to solve mathematical thinking process problems in solving non-routine math problems with subjects classified as high, medium, and low.

a. MFA (High) Subject 1

Problem Number 1

The data on the results of the high-classified subject test (MFA) in answering question number 1 is shown below.

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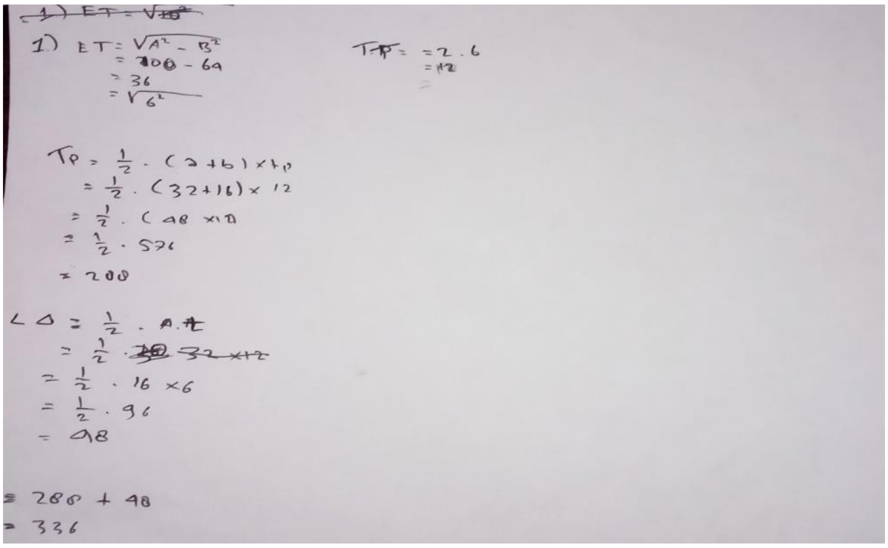

Gambar 2. Jawaban Subjek MFA-1

Based on the answers obtained by the subject above, it can be seen that the subject has not been able to understand the problems that exist in the question, and that the subject does not write down what is known and asked in the problem. The subject has been able to plan and solve problems well. It can be seen in the above subject that the subject already knows the problem to be sought by writing down the formula that will be used to solve the problem, and the subject has also solved the problem with satisfactory results. At the re-checking stage, the subject was able to apply the answer sheet, but the results obtained by the subject were still not satisfactory; the answer written by the subject was incorrect, but the subject had attempted to re-examine the answers obtained, even though the subject's answers had not been satisfactory. As a result, the MFA subject at the entry level did not fulfill the subject (know, want, and introduce aspects). The subject has met at the attack stage (aspects of try, maybe, and why). Furthermore, the subject has passed the review stage (check, reflect and extend aspects).

The subject in the picture above made an error in the steps he took to solve the problem:

1. In the MFA subject image, the subject does not write down what is known and asked about the problem; instead, the subject plans, resolves, and re-examines the problem right away.
2. When re-checking the subject in the MFA subject image, the subject only sums up the results obtained.

As in the preceding subject matter, the subject solves problem 1. Emotionally, he managed to create an enemy who was convinced of the final result that the subject proposed (Mason et al., 2011). The MFA subject's thought process in problem 1 is as follows:

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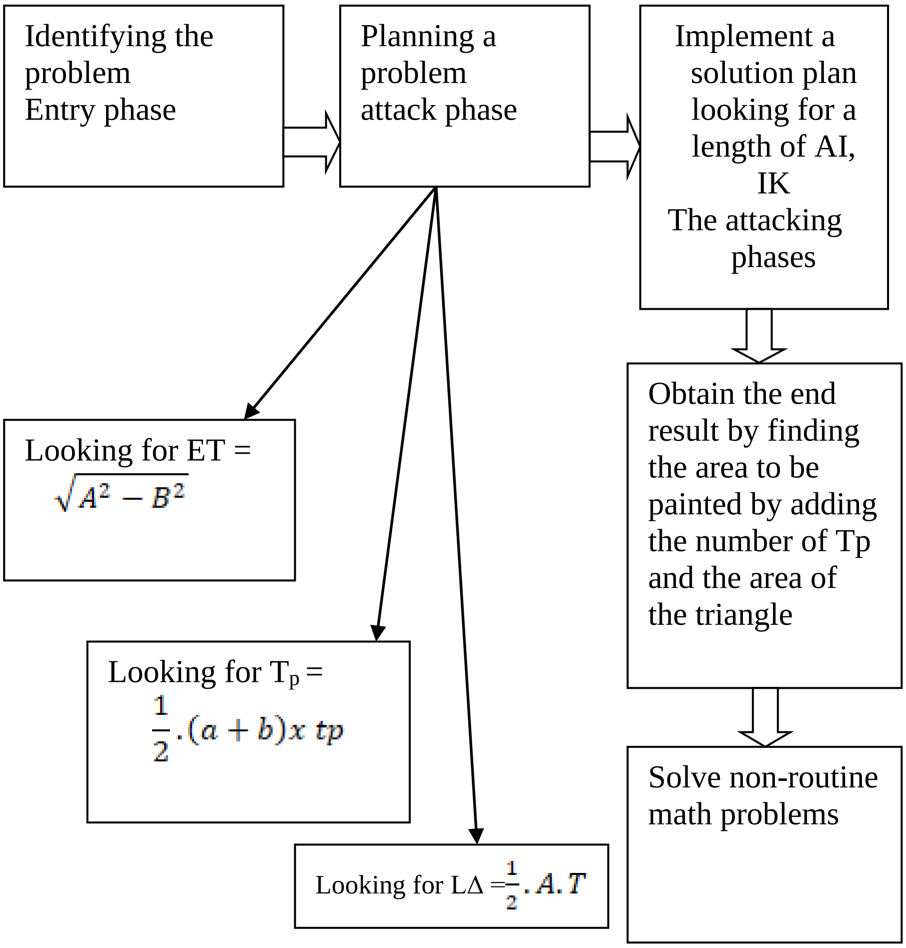

Figure 3. Mathematical Thinking Flow of MFA Subjects in Problem 1

Problem Number 2.

The following are the results of the highly classified subject test (MFA) in solving question number 2:

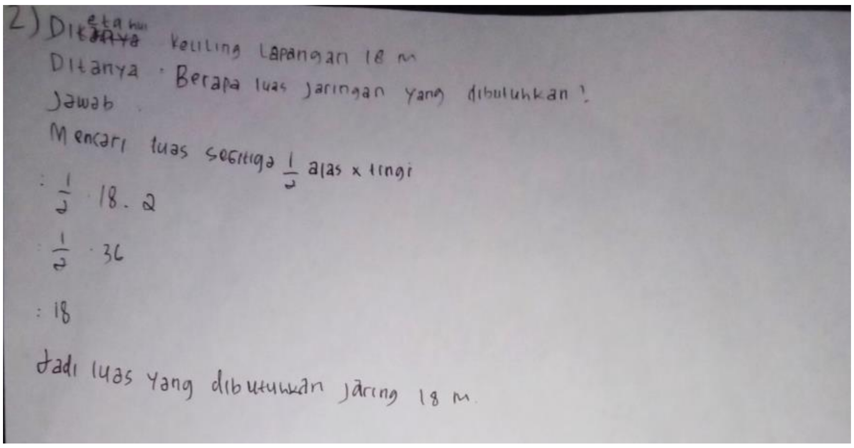

Figure 4. Answers of MFA-2 Subjects

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Based on the subject's answers obtained above, it can be seen that during the process of solving the problem, the subject was able to solve the problems that exist in the question, and the right is proven that in the subject's answer, the subject can write down what is known and asked in the problem. It is proven that the subject plans by looking for the area of the triangle, to solve the problem on the question the subject has been able to apply but the answers obtained by the subject are not perfect. Although the subject's answer is not perfect, the subject has attempted to solve it and has also written down the conclusions contained in the answer. Students have not applied the answers on the answer sheet at the re-checking stage. So, the MFA subject has met the entry stage (know, want, and introduce aspects), the attack stage (try, maybe, and why aspects), and the review stage (check, reflect, and extend aspects) but not all of them. The following is the MFA subject's thought process in problem 2.

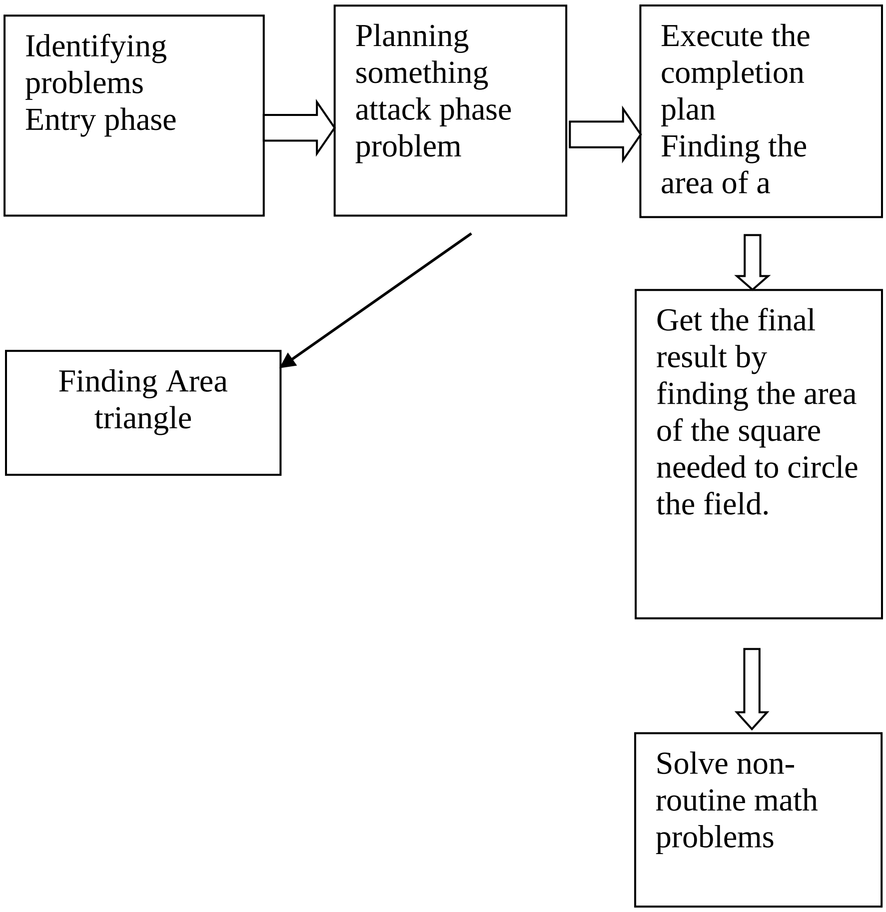

Figure 5. Mathematical Thinking Flow of MFA Subjects in Problem 2

b. Subject 2 MFR (High)

Problem Number 1

The following is the data on the results of the high classified subject test (MFR) in solving question number 1:

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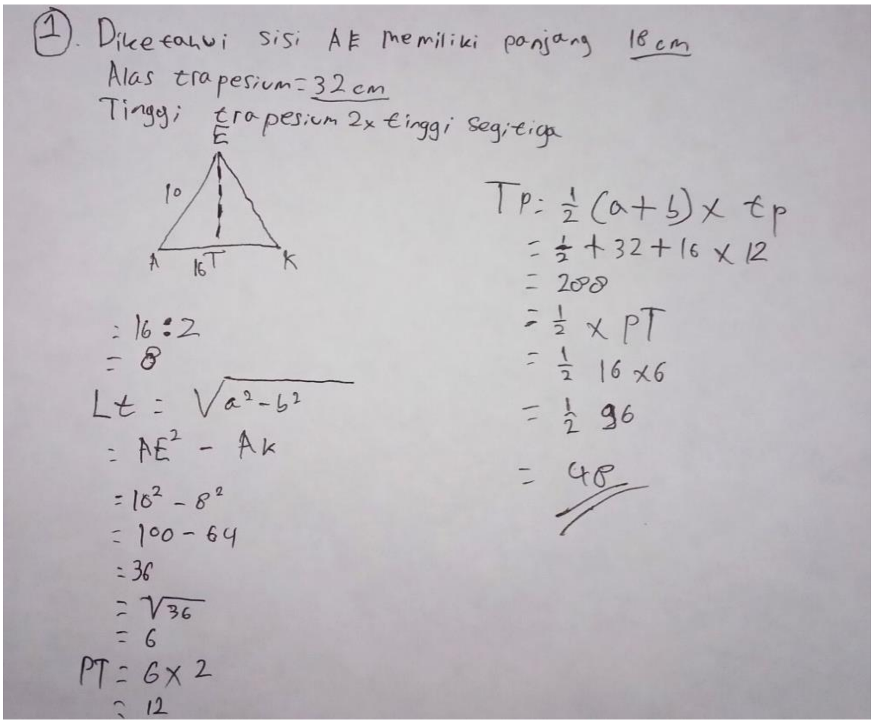

Figure 6. MFR-1 Subject Answers

Based on the answers obtained by the subject above, it can be seen that during the process of solving the problem, the subject was able to understand the problems that exist in the matter, and that in the subject above, the subject has written down what is known and asked in problem 1. The subject is capable of planning and solving a problem well; it can be seen that in the subject above, the subject already knows the problem to be searched for by describing the triangle to be searched for and writing down the formula that will be used to solve the problem; the subject has also solved the problem with satisfactory results. At the re-examination stage, the subject can only solve the problem if he or she has not been able to apply the subject's answer sheet. As a result, the MFR subject at the entry level has fulfilled the subject (know, want, and introduce aspects). The subject has met at the attack stage (aspects of try, maybe, and why). Furthermore, the subject has not passed the review stage (check, reflect and extend aspects).

The subject in the picture above made a mistake in the steps he took to solve the problem.

The subject of the MFR image has not had the opportunity to re-examine the answers that the subject received. The subject did not double-check the area of the triangle. The subject has solved the problem of problem 1 based on the subject matter above; the following is the MFR subject's thinking process on problem 1.

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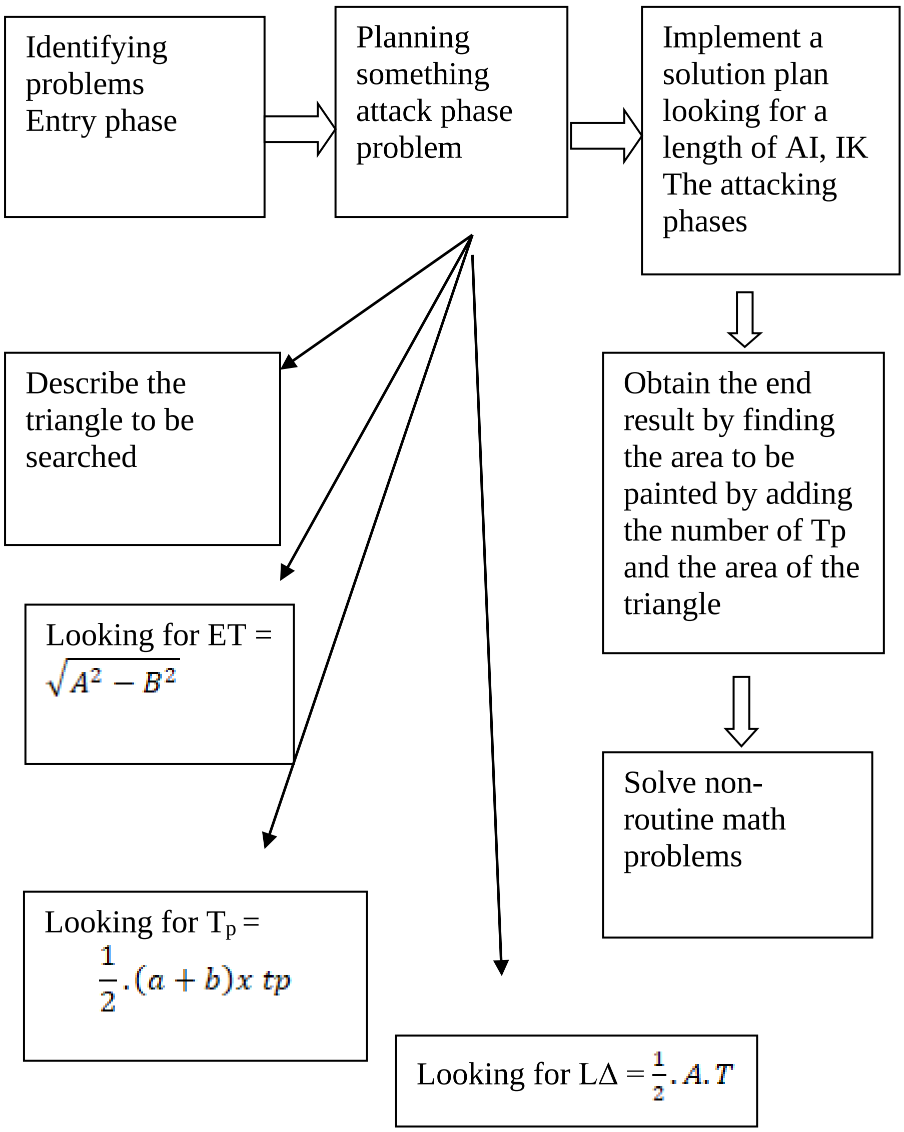

Figure 7. Mathematical Thinking Flow of MFR Subjects in Problem 1

Problem Number 2

The following is the data on the results of the high classified subject test (MFR) in solving the problem in number 2:

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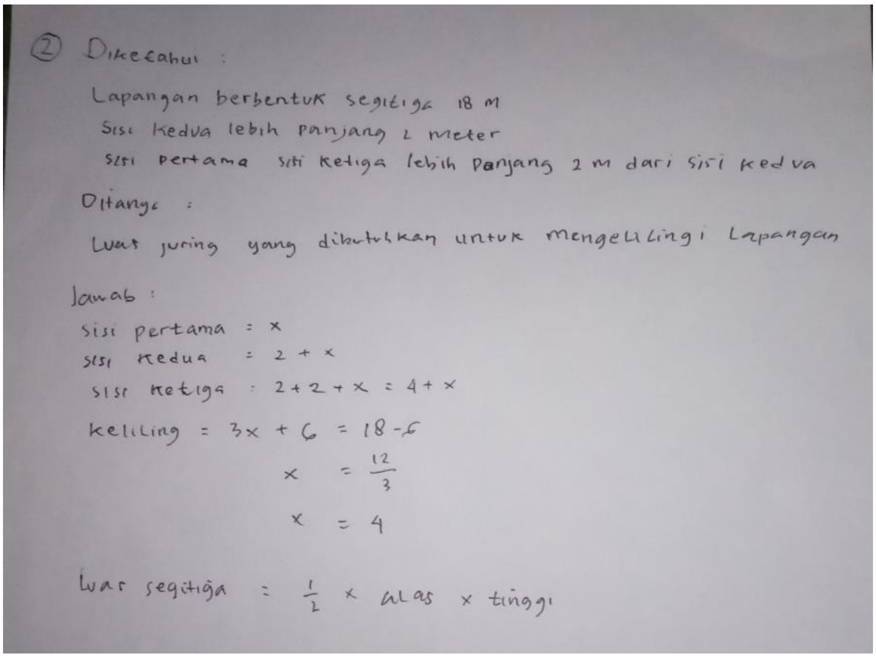

② Diketahui :

Lapangan berbentuk segitiga 18 m

Sisi kedua lebih panjang 2 meter

sisi pertama sisi ketiga lebih panjang 2 m dari sisi kedua

Ditanya :

Luas juring yang dibutuhkan untuk mengelilingi Lapangan

Jawab :

sisi pertama : x

sisi kedua : 2 + x

sisi ketiga : 2 + 2 + x = 4 + x

keliling = 3x + 6 = 18 - 6

$x = \frac{12}{3}$

$x = 4$

Luas segitiga = $\frac{1}{2}$ x alas x tinggi

Figure 8. Answers of MFR Subjects -2

Based on the answers obtained by the subject above, it can be seen that during the process of solving the problem, the subject was able to understand the problems that exist in the matter, and that in the subject, the subject above has written down what is known and asked in the problem 2. When carrying out the problem-solving strategy Based on this problem, it is proven that the subject has been looking for the first side, second side, third side, and circumference of the above problems. Also, write down the formula for triangle area. However, the subject can only answer the question to that extent, so for the stage of re-examining, the subject has not been able to apply the question in the answer sheet, and even though the subject has not been able to fully answer the subject, he has attempted to answer what the researcher provided. As a result, the MFR subject at the entry level has fulfilled the subject (know, want, and introduce aspects). The subject met (aspects of try, maybe, and why) during the attack stage, but not during the review stage (aspects check, reflex, and extend). Here is the MFR subject's thought process on problem 2.

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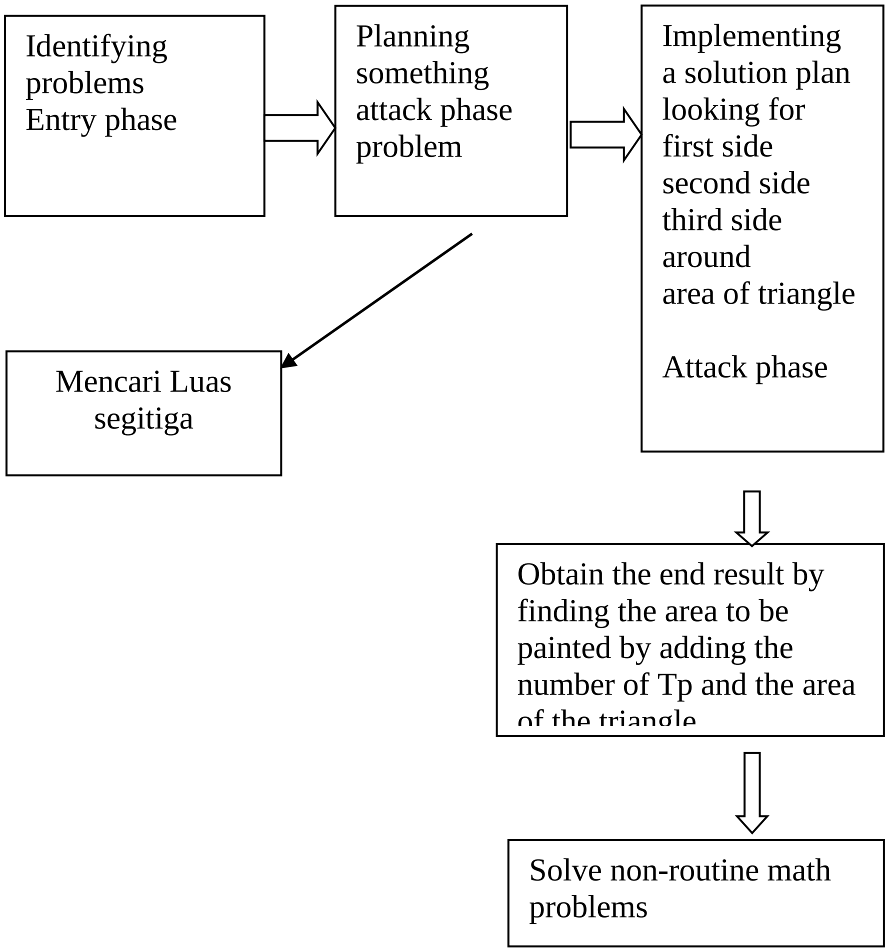

Figure 9. Mathematical Thinking Flow of MFR Subjects in Problem 2

c. Subject 3 JS (Medium)

Problem Number 1

The following is data on the test results of subjects classified as Medium (JS) in solving question number 1.

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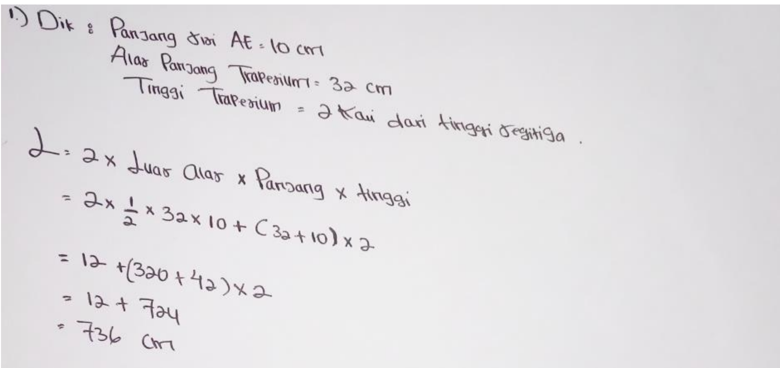
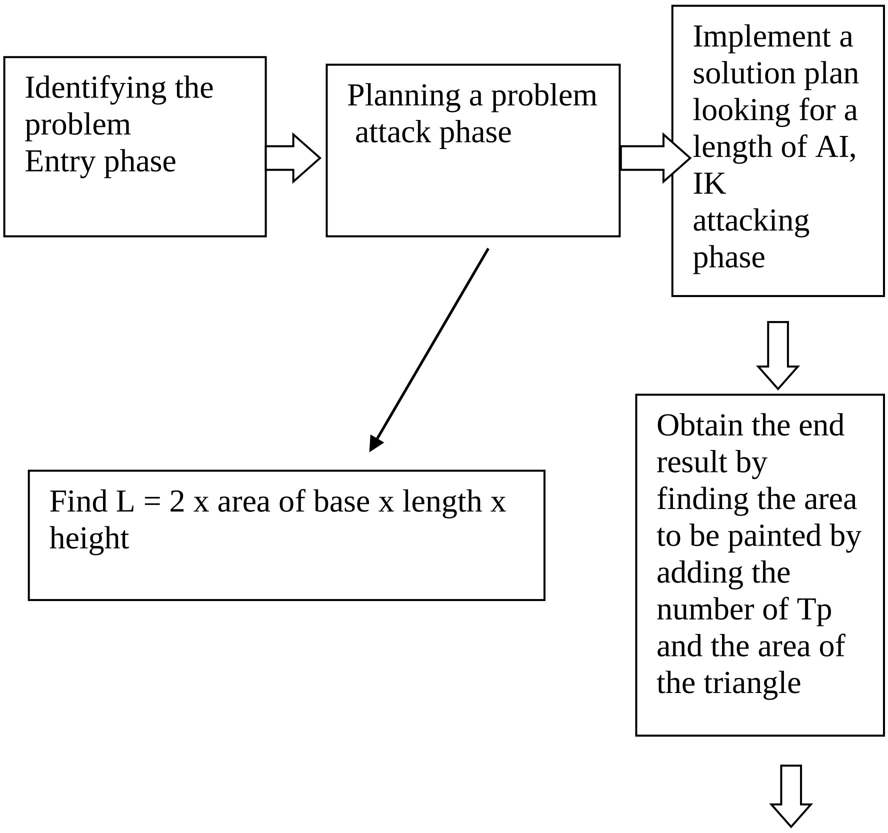


Figure 10. JS-1 Subject Answers

Based on the answers obtained by the subject above, it can be seen that during the process of solving the problem, the subject was able to understand the problems that exist in the question; it can also be seen that the subject above has written down what is known and asked in the problem. The subject was able to write well while planning and carrying out the completion plan. The subject's answers, on the other hand, were incorrect. And, because the students had not been able to apply this answer during the re-examination, the subject only worked on the completion plan's implementation. Problems on the subject of JS In problem 1, the subject did not answer the question correctly, but the subject attempted to answer the question. So, the subject of JS has fulfilled the subject at the entry stage (know, want, and introduce aspects). The subject has met (aspects of try, maybe, and why) at the attack stage, but has not met (aspects of check, reflect, and extend) at the review stage. The following is the subject of JS's thought process on problem 1:



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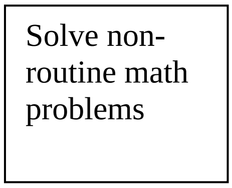


Figure 11. Mathematical Thinking Flow of JS Subjects in problem 1

Problem Number 2

The following is the data on the test results of subjects classified as Medium, (JS) in solving question number 2:

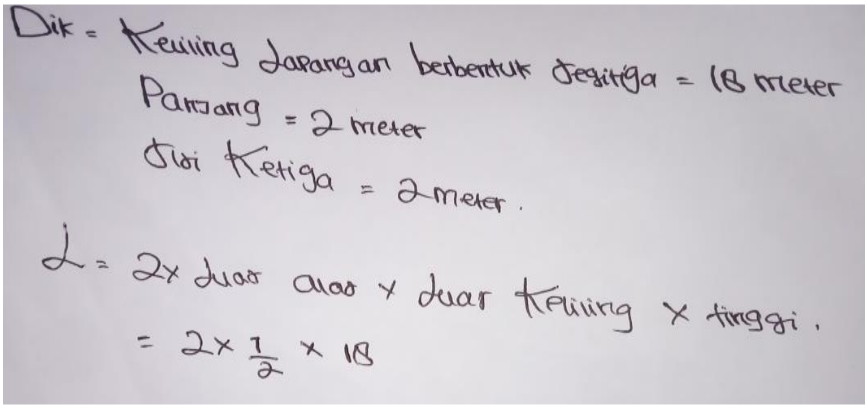
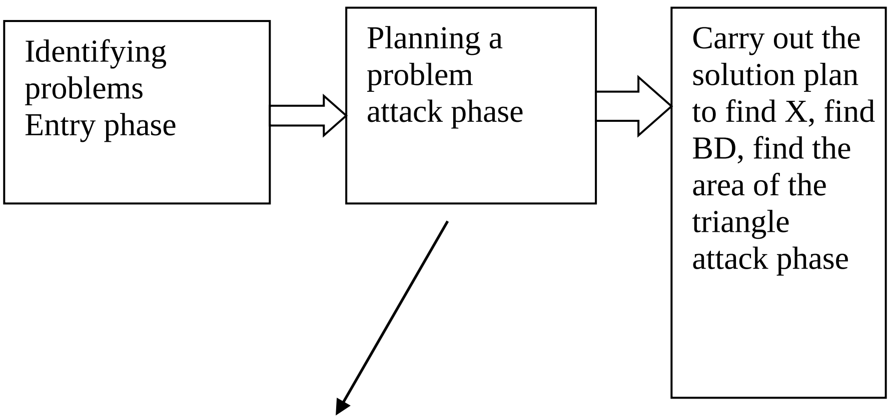

Dik = Keliling lapangan berbentuk segitiga = 18 meter
Panjang = 2 meter
Sisi Ketiga = 2 meter.
L = 2x luas alas x luas keliling x tinggi.
= 2x $\frac{1}{2}$ x 18

Figure 12. JS Subject Answers -2

Based on the answers obtained by the subject above, it can be seen that the subject was able to understand the problems that exist in the matter while solving the problem. In this case, it is clear that the subject has understood the problem in the subject above. It is also clear that the subject has written what is known and asked about the problem in the subject above. The subject only writes one formula to carry out the plan when planning the problem. The subject has not been completed in order to answer the question. Even understanding the subject has not solved the problem. So, the subject of JS has fulfilled the subject at the entry stage (know, want, and introduce aspects). The subject has met at the attack stage (the try aspect). And the subject has not met at the review stage (check, reflect, and extend aspects). The following is the thought process of a JS subject on the problem.



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Find L = 2 x area of base x length x height

Get the final result by finding the area of a triangle with the area of the square needed to circle the field

Solve non-routine math problems

Figure 13. Mathematical Thinking Flow of JS Subjects in Problem 2

d. Subject 4 RZ (Medium)

Problem Number 1

The following is data on the test results of subjects classified as Medium (RZ) in solving question number.

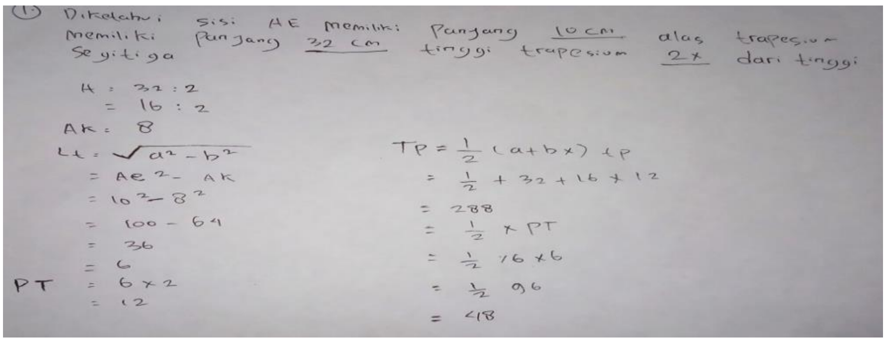

Figure 14. Subject's Answer RZ -1

Based on the answers obtained by the subject above, it can be seen that during the process of solving the problem, the subject was able to understand the problems that exist in the question; it can also be seen that the subject above has written down what is known and asked in the problem. The subject has been able to plan and solve problems

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well. It can be seen in the subject above that the subject already knows the problem to be sought by writing the formula that will be used to solve the problem, and the subject has also completed the problem with satisfactory results. At the re-examination stage, the subject can only solve the problem if he or she has not been able to apply the subject's answer sheet. So, the subject of RZ has fulfilled the subject at the entry stage (know, want, and introduce aspects). The subject has met at the attack stage (aspects of try, maybe, and why). Furthermore, the subject has not passed the review stage (check, reflect and extend aspects). Problems that exist in the subject, the subject does not re-examine the answers obtained by the subject, the subject can only solve the problem. The following is the RZ subject's thought process in problem 1.

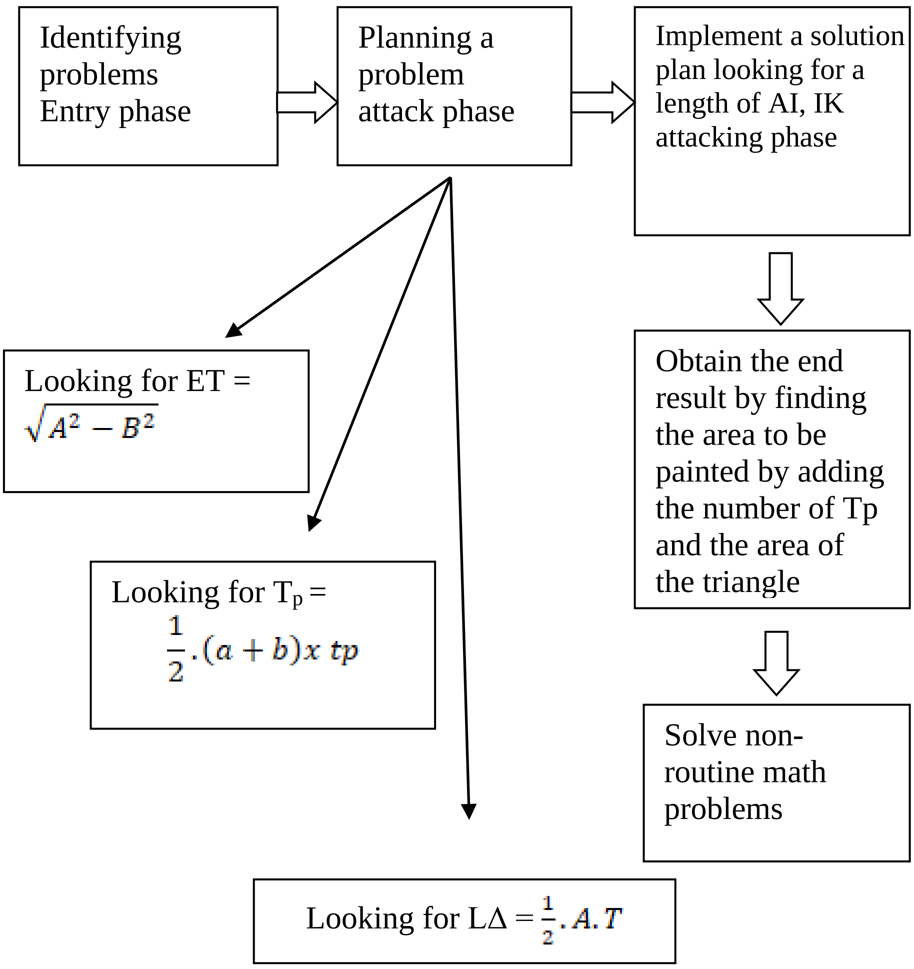

Figure 15. Mathematical Thinking Flow of RZ Subjects in Problem 1

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Problem Number 2

The data on the test results of low-class subjects (RZ) in solving problem number 2 is shown below. There is no answer to number 2 on the answer sheet for the subject of RZ, indicating that the subject of RZ cannot solve non-routine math problems on the Pythagorean material. So RZ does not meet the entry stage (know, want, and introduce aspects), attack stage (try, maybe, and why aspects), or review stage (check, reflect and extend aspects).

e. Subject 5 MRV (Low)

Problem Number 1

The data on the results of the low-class subject test (MRV) in solving problem number 1 is shown below. There is no answer to number 1 on the MRV answer sheet, indicating that the MRV subject cannot solve non-routine math problems on the Pythagorean material. As a result, the MRV subject fails to pass the entry stage (know, want, and introduce aspects), attack stage (try, maybe, and why aspects), and review stage (check, reflect and extend aspects).

Problem Number 2

The following is data on the results of the Low Classified Subject Test (MRV) in solving question number 2.

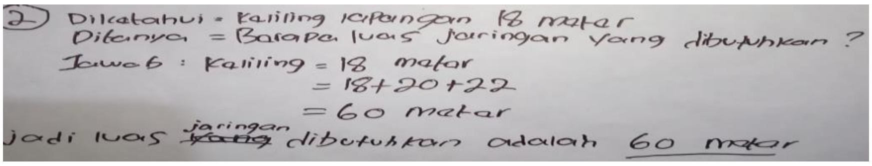

Figure 16. MRV-2

Based on the answers obtained by the subject above, it can be seen that the subject was able to understand the problems that exist in the matter while solving the problem. In this case, it is clear that the subject in the subject above has understood the problem. It is also clear that the subject in the subject above has written down what is known and asked about the problem. However, when planning to solve the problem, the subject did not make a plan for completing the answer sheet; instead, the subject solved the problem on the question by looking around the problems provided by the researcher. The subject was able to draw conclusions from the completion results that the subject had obtained. Although the subject's response is unsatisfactory, the subject has attempted to solve the problem. So, the MRV subject has met the entry stage (know, want, and introduce aspects), the attack stage (try, maybe, and why aspects), but has not met the review stage (check, reflect, and extend aspects). The following is the MRV subject's thought process in problem 2.

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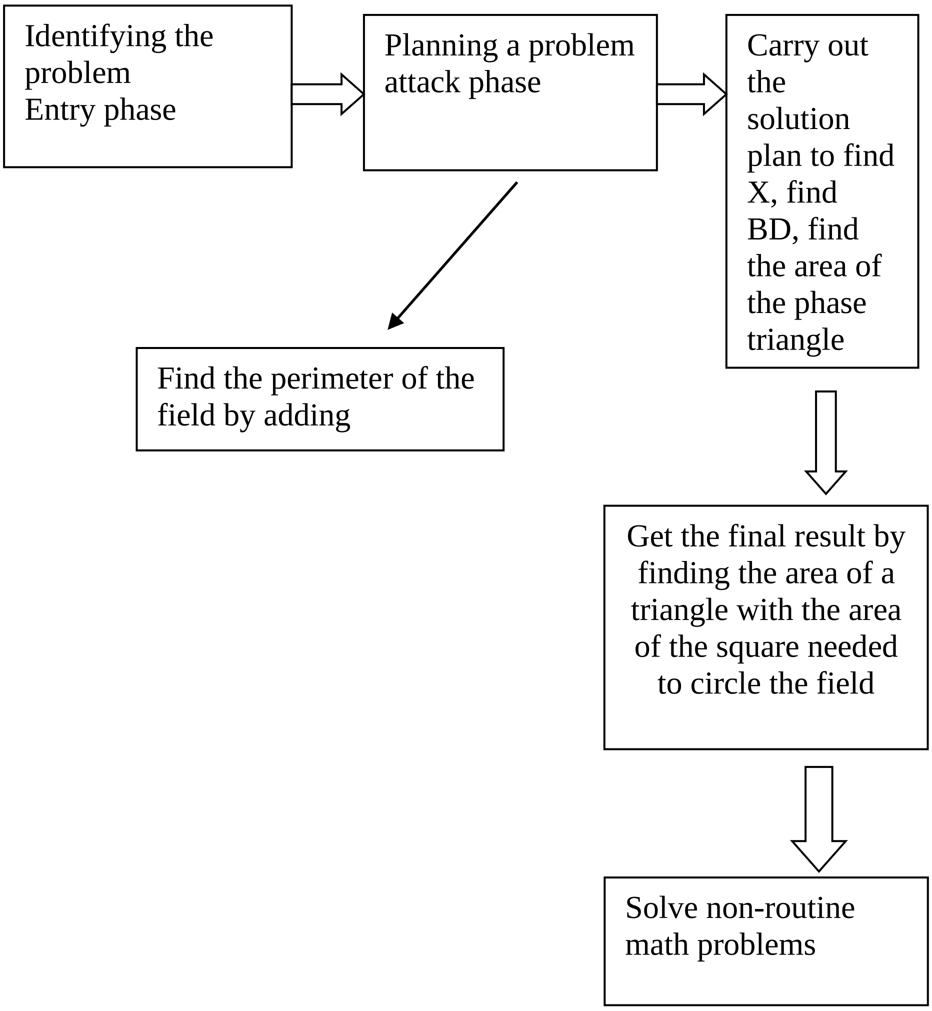
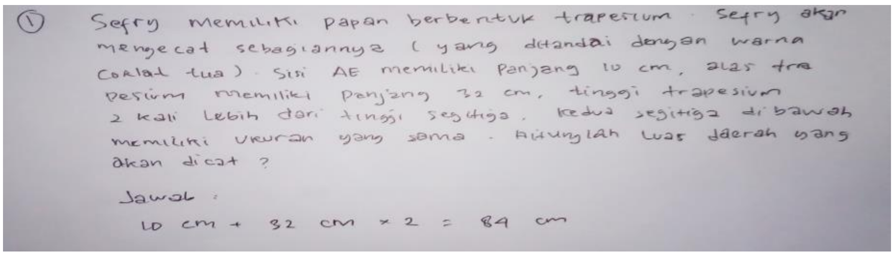


Figure 17. Mathematical Thinking Flow of MRV Subjects in Problem

f. Subject 6 P (Low)

The following is the data on the test results of subjects classified as Low (P) in solving the number 1 question.

Problem Number 1


1. Sefry memiliki papan berbentuk trapesium. Sefry akan mengecat sebagiannya (yang ditandai dengan warna coklat tua). Sisi AE memiliki panjang 10 cm, alas trapesium memiliki panjang 32 cm, tinggi trapesium 2 kali lebih dari tinggi segitiga. Kedua segitiga di bawah memiliki ukuran yang sama. Hitunglah luas daerah yang akan dicat?

Jawab:

10 cm + 32 cm × 2 = 84 cm

Figure 18. Subject's Answer P -1

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The data on the test results of low-class subjects (P) in solving problem number 1 is shown below. Based on the answers obtained by the subject above, it can be seen that during the problem-solving process, the subject rewrites the questions given by the researcher on the subject's answer sheet, and the subject answers the problem. Number one, the subject cannot understand the problem by adding and reversing the length, base, and height. It has been demonstrated that the subject is unable to write down what is known and answered on the answer sheet. The answer sheet cannot be used during the planning, completion, and re-examination stages of the subject. So subject P does not meet the entry stage (know, want, and introduce aspects), attack stage (try, maybe, and why aspects), and review stage requirements (check, reflect and extend aspects).

Problem number 2

The data on the test results of low-class subjects is shown below (P) Because there is no answer number 2 in meny P, it is clear that subject P is unable to solve non-routine math problems using Pythagorean material. So subject P does not meet the entry stage (know, want, and introduce aspects), attack stage (try, maybe, and why aspects), and review stage requirements (check, reflect and extend aspects).

2. Student Interview Results

After analyzing the results of the second test of students' mathematical thinking processes in solving non-routine math problems on Pythagorean material, the results of the interview data were used. The previous two researchers were able to obtain data and subjects to be continued in the interview test based on the results of the previous two researchers. The results of this interview will be used to strengthen the initial guess on the results of the analysis of students' mathematical thinking questions in solving non-routine math problems on Pythagorean material, as well as to determine how students' thinking processes work on non-routine math problems. According to the findings from the six subjects interviewed by the researchers, some students "preferred non-routine questions rather than routine" when solving non-routine questions, students said that non-routine questions were difficult for him.

However, when students completed the researcher's questions, some students were unable to use the correct formula, while others were able to use the Pythagorean formula correctly.

According to their interview explanation, "I find it difficult to work on the questions in the formula section," in question number 2, most students left their answers blank on the answer sheet, and only a few students were able to fill in the answers on the answer sheet, even though many students' results were still incomplete. According to their interview explanation, "I can solve the problem if I already understand the question".

Based on the results of the preceding tests and interviews. The researcher concludes that the mathematical thinking process demonstrated by the research subject (purposeful subject) is not based on standard stages and adjusts the types of mathematical problems it faces.

When students received the problem sheet from the researcher, the majority of them stated that they had never studied the Pythagorean topic with problems like this before. The rest of the students only complained, "ouch, the questions given were very difficult, not as easy as the questions given in yesterday's question (diagnostic questions)", when they saw the researcher's question sheet.

The researcher suggested to the students that they ask for help so that they could work on the questions by contracting, reading the questions slowly, and reading the instructions in the questions before they worked on them. Furthermore, the researcher informed the students that the questions they were working on had nothing to do with math scores in Ariyeni's mother's math subjects, and that the researchers only wanted your honesty to get answers that truly mattered. Students identify a well-defined problem (well deficit).

Some students leave the answer sheets blank. When the researcher conducted a conversation with the subject, he learned that he preferred routine questions over non-routine questions. Students with idealism who are thinking about seeking information and knowledge that fail will be interpreted, students who do not have the ability with peers who are thought to have no capacity for more than themselves. They insist on their own ability and success in solving problems on their own.

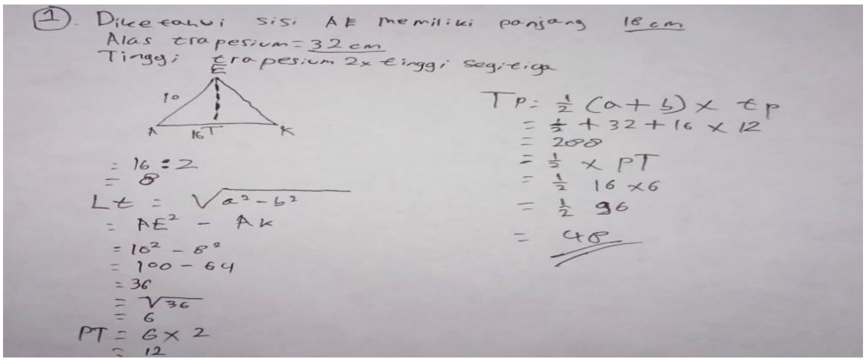

Figure 19. Problem Solving Results of MFR (High) Subject in Problem 2

Idealism is a school of educational philosophy that believes that the highest form of knowledge and truth is an idea (KBBI online). As a result, the adopted attitude prioritizes ideas, even if the majority are contrary to the environment and conditions of reality.

Idealism becomes a very powerful motivator in determining students' "doing/not doing" by the subject. Problems that affect one do not affect something considered extremely difficult. His surroundings will serve as an example of an inappropriate attitude in his mindset. For example, the subject imitates peers and searches books and the internet for solutions to these problems. However, the researcher was only interested in confirming the students' mathematical abilities, and these students tried to answer the question more than their peers who tried first, but their peers' answers did not answer the question. The subject has answered the question with the correct formula and method in the diagnostic test with non-routine mathematical problems. Although there are subjects who answer correctly, the MFR subject is more precise in answering the diagnostic questions given by the researcher. According to the results of the interview with the MFR subject, the subject preferred non-routine questions over routine questions, and those non-routine questions were more challenging.

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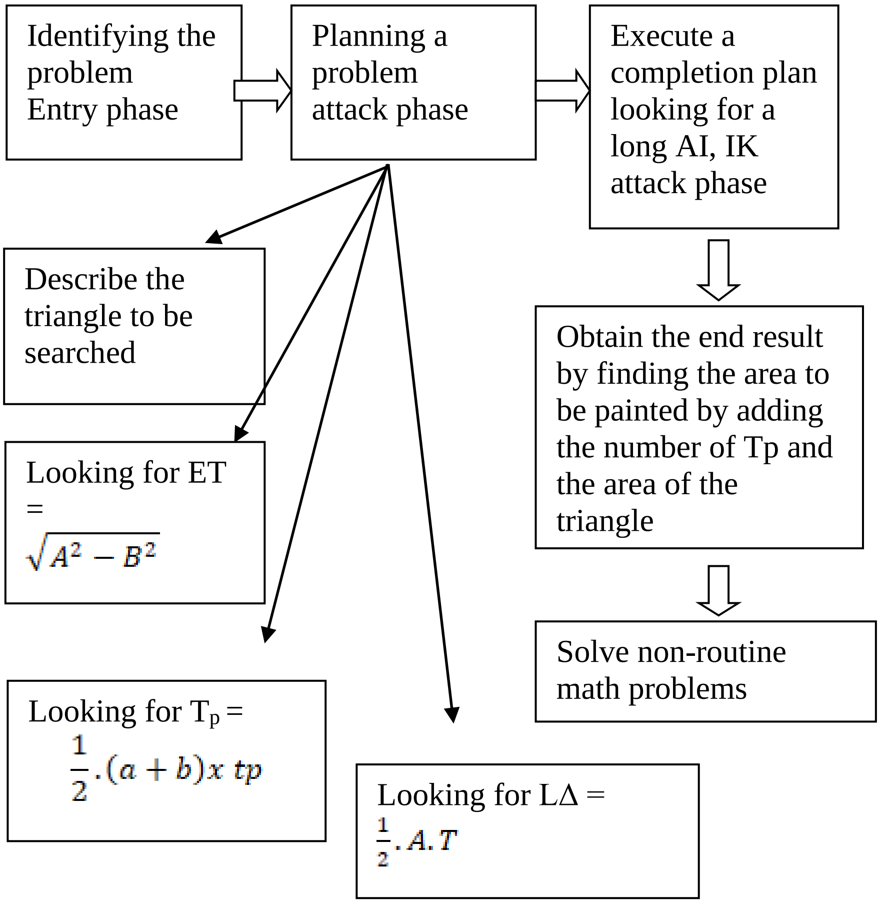

Figure 20. Subject Problem-Solving Process with Idealism Thinking

This section will discuss the findings of a study on students' mathematical thinking processes in solving non-routine mathematical problems based on Mason's theory, as explained in the theoretical study. Mason's theory is a learning theory with three stages of entry (know, want, introduce aspects). Stage of attack (try, maybe, why). And then there's the Review stage (aspect check, reflect, and extend) (Mason dan Burton, 2010). According to the three stages, at the entry stage, students identify a problem, construct what is known, find a quantity that is further processed with a formula, construct what is asked, and order in a problem to be solved. The next stage is the attack stage, in which students attempt to solve problems through systematic and sequential steps, and in which students use known and understood formulas to further process what was known and understood at the entry stage. Following the completion of the systematic steps in the problem solving process, the next stage is the review stage, in which students make a final statement concluding the entire series in the problem solving process, linking what is obtained and constructed at the attack stage with the results obtained and constructed at the entry stage (Firdaus dan Ni'mah, 2020). As a result, Mason's theory can be used to determine the mathematical thinking process in solving non-routine mathematical

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problems. In which a person compares new information to information stored in memory or rearranges and expands information to achieve a goal and find an answer in a perplexing situation (Miraglia dkk., 2011).

According to the results of the diagnostic test research given to students in one class, 21 students took the test, and 6 subjects will be taken to continue the second test. Six students who have been classified as high, medium, or low will be taken based on the results of the diagnostic test; thus, two students are classified as high, two students are classified as moderate, and two students are classified as low. According to the interviews they conducted, "the questions given are related to the previous lesson" after the selected subject continues to take the second test.

According to the data, the results of the subject's research have been completed in accordance with Mason's theory, and there are also subjects who are not in accordance with Mason's theory, due to various limitations that the subject has. The following is an explanation and analysis of Mason's theory's three stages: entry (know, want, introduce), attack (try, maybe, why), and review (check, reflect, extend).

1. Entry

The entry stage is based on the analysis of research results performed by all subjects with high, medium, and low abilities. In problem 1, in subject 1 (highly classified), in problem 2, in subject 2 (highly classified), in problems 1 and 2, 3 (medium classification) Subject 4 (medium classification) in problem 1, in subject 6 problems 1 has fulfilled the subject of the Entry stage (aspects of know, want and introduce). In other words, the subject has reached the entry stage during the thought process of solving non-routine mathematical problems (Astriyani, 2019).

2. Attack

The Attack stage focuses on problems 1 and 2 based on an analysis of research findings from all high, medium, and low capable subjects. Subject 1 (highly classified) on problems 1 and 2, subject 2 (highly classified) on problems 1 and 2, subject 3 (moderately classified) on problems 1 and 2, subject 4 (medium classified) on problem 1, and subject 5 (lowly classified) on problem 1 (Aspects of try, maybe, and why). Subjects 1, 2, and 4 solved problems with satisfactory results, whereas subject 3 completed questions according to the Attack stage, but the subject's results were unsatisfactory. Students can explore their creativity at this stage because they can respond to the researcher's questions with their own version. The subject has attained an understanding of the level of consciousness, thinking nerves refer to a person's emotional and cognitive success in solving complex as well as higher mathematical problems. think in order (Mason dkk., 2011). According to the interview results, "they prefer non-routine math problems over routine questions, because non-routine questions are challenging for me." According to the subject's explanation in the interview, "because the formula is the most efficient formula for working on the problem".

3. Review

The Review stage focuses on questions 1 and 2 and is based on an examination of the findings of research conducted by all subjects with high, medium, and low abilities.

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At this point, only one subject has passed the Review stage (check, reflect, extended), which is subject 1 (high classifiable) The subject has met at this stage, but the results obtained by the subject in re-examination have not been satisfactory, even though the results obtained by the subject have not been satisfactory to the subject. I attempted to double-check the results. Students should be able to re-examine the results obtained at this point to determine whether the answers are correct and in accordance with what was asked in the problem (Widyastuti, 2015). This is consistent with the findings that for students with intermediate abilities, the entry stage has been met, but in the attack aspect, not all components are met (only try and maybe), and the why component cannot give reasons when interviewed. Finally, during the review stage, I was unable to relate to what was depicted in the entry. For students with low ability, the answer does not correspond to what is given.

So, based on the discussion of the study's findings, it can be concluded that the mathematical thinking process in solving non-routine math problems is not optimal, as students did not apply the answer sheets to problems 1 and 2 during the review stage.

CONCLUSION

Based on the findings of the research, it is possible to conclude that in the diagnostic test tests that have been administered to students, the results of the classification data obtained by high-ability students totaling 3 students are 14 percent, students with moderate abilities totaling 7 students are 33 percent, and students with low abilities totaling 11 students are 53 percent. The flow of thought in problem 1 (problem number 1). For high students, it includes the entry, attack, and review phases; for moderate students, it includes the attack and review phases; and for low students, it does not meet the phases in the students' thinking process. The flow of thought process in problem 2 (question number 2) The entry and attack phases are met by high students, the entry and attack phases are met by moderate students, and the entry phase is met by low students.

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REFERENCES

Astriyani, A. (2019). Analisis Proses Berpikir Matematis Peserta Didik Dalam Menyelesaikan Aplikasi Turunan. *Jurnal Pendidikan Surya Edukasi (JPSE)*, *5*(2), 137.

C. Arslan., & M. A. (2017). Learning to solve non-routine mathematical problems. *İlköğretim Online*, *6*(1), 50–61.

D. Ariskari, et al. (2019). Pengembangan Modull Matematika Berbasis Problem solving pada materi vector. *Desimal Jurnal Matematika*, *2*(3), 250.

J.Miraglia, L., J King, F., & D. R. (2011). Seeing The Light : Lumenisecent Reporter Gene Assays. *Combinatorial Chemistry & High Throughput Screening*, *14*(8), 648–657.

Kinard, J. (2017). *Method And Apparatus For Creating Rigorous Mathematical Thingking*.

Mason, J., Burton, L., & Stacey, K. (2011). *Thinking Mathematically Second Edition*. Pearson

Education Limited.

Mason, J., Burton, L., & S. K. (2010). *Thinking Mathematically. Second Edition.* Addison Wesley.

Mason. J, et al. (2010). *Thingking Mathematically: second edition*. Pearson Education.

Mulyati, T. (2016). Kemampuan Pemecahan Masalah Matematis Siswa. *Eduhumaniora Jurnal Pendidikan Dasar Kampus Cibiru.*, *3*(2), 5–6.

N. Islamiah et al. (2018). Analisis Hubungan Kemampuan Pemecahan Masalah Matematis dan Self Confidence Siswa SMP. *Journal on Education*, *1*(1), 47–57.

NCTM. (2000). *Curriculum and Evaluation Standard For School Mathematics*. VA:NCTM.

Ni'mah, F. I. F. and K. (2020). Deskripsi Proses Berpikir Matematis Siswa Dalam Memecahkan Masalah Konsep Barisan Berdasarkan Teori Mason. *Jurnal Educatio FKIP UNMA*, *6*(2), 713–714.

P. M. Farib, et al. (2019). Proses berfikir kritis matematis siswa sekolah menengah pertama melalui discovery learning. *Jurnal Riset Pendidikan Matematika*, *6*(1), 99–117.

Pasandaran., R. F. (2019). Representasi dalam penyelesaian masalah non rutin. *Guru Tua : Jurnal Pendidikan Dan Pembelajaran, 2*(1), 46.

Setiawan., S. M. A. & R. (2018). Analisis Penggunaan Strategi Menerka Lalu Menguji Kembali dan Melihat dari Sudut Pandang Lain Dalam Matematika Non-Rutin Untuk Penyelesaian Mencari Nilai x Pada Suatu Persamaan. *Jurnal Pendidikan Matematika Dan Matematika SOLUSI*, *2*(1), 64.

Sgela., L. (2014). Efektifitas Pendekatan Pembelajaran Matematika Realistic Indonesia (PMRI) Untuk Peningkatan Kemampuan Berfikir Matematis Siswa. *Jurnal Derivat*, *1*(2), 2.

Sugiyono. (2018). *Metode Penelitian Kuantitatif ,Kualitatif dan R&D*. Alfabeta.

Sumarno, U. (2010). *Berikir dan Disposisi Matematika : Apa, Mengapa dan Bagaimana dikembangkan pada peserta didik*. FMIPA UPI.

Supardi, U. S. (2015). Peran Berpikir Kreatif dalam Proses Pembelajaran Matematika. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *2*(3), 249.

Widyastuti., R. (2015). Proses Berpikir Siswa Dalam Menyelesaikan Masalah Matematika Berdasarkan Teori Polya Ditinjau Dari Adversity Quotient Tipe Climber. *Al-Jabar:Jurnal Pendidikan Matematika*, *6*(2), 183.

Winarni, E. W. (2018). *Teori dan praktik Penelitian kuantitatif kualitatif, PTK, R & D*. Bumi Aksara.