Edumatica: Jurnal Pendidikan Matematika
Volume 13 Number 03 December 2023

Submited : 17 October 2023
Revised : 28 December 2023
Accepted : 30 December 2023

Analisis Kemampuan Pemecahan Masalah Matematika Siswa Kelas VII Pada Materi Segitiga dan Segiempat

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Abstrak

Kemampuan pemecahan masalah merupakan kemampuan dasar matematika yang harus dikuasai setelah siswa belajar matematika. Penelitian ini bertujuan untuk mendeskripsikan kemampuan pemecahan masalah matematika siswa kelas VII MTs Riyadlotul ‘Uqul Tangerang. Metode penelitian yang digunakan ialah penelitian kualitatif deskriptif dengan teknik pengambilan sampel yang digunakan adalah metode purposive sampling. Subjek dalam penelitian ini adalah siswa kelas VII MTs Riyadlotul ‘Uqul Tangerang sebanyak 31 siswa, di mana tiga siswa dipilih berdasarkan kemampuannya memecahkan masalah matematika pada tingkat tinggi, sedang, atau rendah. Teknik pengumpulan data dalam penelitian ini adalah dengan tes, wawancara, dan dokumentasi. Hasil penelitian menunjukkan bahwa kemampuan pemecahan masalah matematika siswa kelas VII Mts Riyadlotul ‘Uqul pada materi segitiga dan segiempat masih tergolong rendah sesuai dengan indikator Polya. Kemampuan pemecahan masalah matematika kategori tinggi, sedang dan rendah, diperoleh capaian tertinggi siswa pada keempat indikator pemecahan masalah matematika adalah pada indikator memahami masalah. Siswa sudah mampu mengidentifikasi apa yang diketahui dan ditanyakan dengan tepat. Sementara itu capaian terendah siswa ada pada indikator memeriksa kembali atau menginterpretasikan hasil yang diperoleh.

Kata Kunci: analisis, kemampuan pemecahan masalah matematika, segitiga dan segiempat

Analysis of Class VII Students' Mathematical Problem-Solving Abilities on Triangles and Quadrilaterals

Abstract

Problem-solving skills are basic mathematical skills that must be mastered after students learn mathematics. This study aims to describe the mathematical problem solving ability of grade VII MTs Riyadlotul 'Uqul Tangerang students. The research method used is descriptive qualitative research with the sampling technique used is the purposive sampling method. The subjects in this study were 31 students of grade VII MTs Riyadlotul 'Uqul Tangerang, where three students were selected based on their ability to solve math problems at a high, medium, or low level. Data collection techniques in this study are by tests, interviews, and documentation. The results showed that the mathematical problem solving ability of grade VII students of Mts Riyadlotul 'Uqul on triangular and quadrilateral material was still relatively low according to the Polya indicator. The ability to solve high, medium and low categories of mathematical problems, obtained the highest achievement of students on the four indicators of solving mathematical problems is on the indicator of understanding problems. Students are already able to identify what is known and asked appropriately. Meanwhile, the lowest achievement of students is in the indicator of re-examining or interpreting the results obtained.

***Keywords**: analysis; mathematics problem solving skill; triangels and rectangels*

INTRODUCTION

The problem-solving approach in mathematics education in Indonesian schools has been adopted since the 2006 Mathematics Curriculum. However, the application of learning that begins with posing a new problem began in the 2013 Mathematics Curriculum. Its implementation is then emphasized through a scientific approach with the aim of developing students' attitudes, knowledge and skills, which are outlined for each unit of education in accordance with the Regulation of the Minister of Education and Culture Permendikbud Number 54 of 2013 (Permendikbud, 2013).

Problem solving is at the heart of mathematics learning and any creative mathematical activity requires engagement in the act of problem solving. ((Pimta et al., 2009; Yeliz, 2015) It can not only improve students' imagination (Wibowo et al., 2021), but also contributes to the development of students' creativity (Suastika, 2017) and supports students' understanding of the material (Mulyati et al., 2021). In learning mathematics, it is necessary to have problem solving skills. Problem solving ability is one of the learning objectives of mathematics that must be achieved by students found in the Regulation of the Minister of National Education Number 22 of 2006. (Suryani et al., 2020). Furthermore, Phonapichat et al. (Simamora et al., 2018) said the main purpose of teaching mathematics is to provide opportunities for students to overcome problems that arise in everyday life.

In everyday life the learning process of problem solving skills is very important. Problem solving is the first step in developing students' ideas (Wahyudi & Anugraheni, 2017). Therefore, in overcoming mathematical problems, students' mathematical problem solving skills are needed, so problem solving is a process of ideas to find solutions to problems. Another opinion also says that problem solving is a learning approach that involves active students optimally which allows students to explore, observe, experiment, and investigate. This aims to facilitate students' understanding of the subject matter obtained as well as a supporting medium to make students more active and independent. (Bernard et al., 2018). From the description above that students are required to be active in expressing their opinions so as to facilitate student mathematical problem solving. Problem solving is also a process or individual effort to respond to or overcome obstacles or obstacles when an answer or answer method is not yet clear (Siswono, 2016).

Mathematical problem solving ability is a complex cognitive activity, as a process to overcome a problem encountered and to solve it requires a number of strategies. Training students with problem solving in mathematics learning is not just expecting students to be able to solve the problems or problems given, but it is hoped that the habit of carrying out the problem-solving process will make them able to live a life full of complex problems. (Harahap Elvira, 2020). Students' mathematical problem solving ability can be interpreted as the ability of students to understand problems, plan problem solving strategies, carry out the chosen solution strategy, and re-examine the solution to the problem to then take the solution systematically and inseparably with the right representation of the problem. (Saragih & Habeahan, 2014); Polya, 1973; Batubara et al., 2017; Sajadi et al., 2013). Mathematical problem solving ability is the ability to solve problems related to mathematics. According to ((Sahrudin, 2016) "Mathematical problem solving ability is the ability to solve math problem solving problems by paying attention to the stages of problem solving".

The reality found at school shows that students' mathematical problem solving skills are still relatively low. (Asih & Ramdhani, 2019). The low mathematical problem solving ability can be seen that students are less able to solve problem solving problems and students only memorize formulas without understanding concepts so they cannot solve problems properly. The results of observations made at MTs Riyadlotul 'Uqul Tangerang, it is known that students' problem solving skills still have not reached the optimal level. This information was obtained through observations and interviews conducted by researchers. According to the teacher interviewed by the researcher, students' mathematical problem solving ability is one aspect that needs special attention. The teacher argued that when students are faced with problem solving problems that have routine patterns, they are able to solve them well. However, when faced with non-routine problems, many students experience difficulties.

This study makes a significant contribution in understanding and analyzing the mathematical problem solving ability of seventh grade students, especially on the topic of triangles and quadrilaterals. Through an in-depth analysis approach, this study tries to identify patterns of thinking and common

 Print ISSN: 2088-2157, Online ISSN: 2580-0779

mistakes that students may experience when facing math problems related to these materials. By focusing on triangles and quadrilaterals, this research is expected to provide in-depth insight into how students understand and apply mathematical concepts in a geometric context. Based on the problems that have been described, this study aims to describe the mathematical problem solving ability of seventh grade students of Mts Riyadlotul 'Uqul. It is hoped that this research can be used as a basis for providing teacher assistance to students as a process of improving math problem solving.

METHOD

The research method used is descriptive qualitative. This research was conducted to obtain information or an overview of students' mathematical problem solving skills on triangle and quadrilateral material. The research subjects in this study were seventh grade students of Mts Riyadlotul 'Uqul totaling 31 students. Samples were taken from the research subjects using *purposive sampling* technique where 3 students would be selected according to the categories of high, medium and low mathematical problem solving ability as follows:

Table 1. *Category of Students' Mathematics Problem Solving*

Range of Problem Solving Ability	Category
$0 \leq x < 60$	Low
$60 \leq x < 80$	Medium
$80 \leq x < 100$	High

Mathematical problem solving ability is analyzed based on Polya's theory with the following scoring guidelines:

Scoring Guidelines for Mathematical Problem Solving Ability

Aspects measured	Description	Score
Understanding the Problem	Students do not mention what is known and what is asked.	0
	Students do not mention what is known but mention what is asked or vice versa	1
	Students mention what is known and what is asked but less precise	2
	Students mention what is known and what is asked correctly	3
Making a Problem Solving Plan	Students do not write the problem solving formula	0
	Students write down the problem solving formula but it is not correct	1
	Students write the problem solving formula correctly	2
Finalizing the Plan	Student does not answer the question or answers incorrectly	0
	Students answer the questions as planned but most of the answers are wrong.	1
	Students answer the questions as planned but most of the answers are correct	2
	Students answer the question by writing the answer correctly and completely	3
Checking Back	Students do not conclude the answer	0
	Students can interpret the results obtained but less precise	1
	Students can interpret the results obtained completely and correctly	2

In this study, data collection was conducted through various methods such as tests, documentation, and interviews. Furthermore, data analysis used the approach proposed by

Miles and Huberman which consists of three main stages, namely data reduction, data presentation, and conclusion drawing. To ensure data validity, technical triangulation was conducted, which involved examining data from several subjects using different methods, such as the problem-solving ability test and interview guidelines.

RESULTS

The research was conducted in class VII Mts Riyadlotul 'Uqul on triangle and quadrilateral material. The instrument used is an instrument in the form of a math problem solving ability test sheet. The mathematical problem solving ability test instrument is used to determine students' mathematical problem solving ability in solving triangle and quadrilateral problems based on indicators of problem solving ability based on Polya's theory. Mathematics problem solving ability questions given to students consist of 5 essay questions that have been previously validated by experts. The following presents the overall math problem solving ability.

Table 3. *Results of Mathematics Problem Solving Ability*

Respondents	Value
1	38
2	34
3	30
4	60
5	26
6	26
7	64
8	56
9	36
10	24
11	28
12	24
13	26
14	36
15	82
16	24
17	30
18	26
19	24
20	28
21	30
22	34
23	26
24	34
25	32
26	34
27	24
28	60
29	94
30	82
31	22

After obtaining the calculation of the final score of students' overall mathematical problem solving ability, then the values are categorized according to the categories proposed by (Ani & Rahayu, 2018) which are presented in the following table.

Print ISSN: 2088-2157, Online ISSN: 2580-0779

Table 4. *Student Category Grouping*

No.	Value	Number of Students	Category
1	0 - 59	24	Low
2	60 - 79	4	Medium
3	80 - 100	3	High
	Total	31	

Table 4 shows that most of the seventh grade students of Mts Riyadlotul 'Uqul Tangerang have low math problem solving skills, around 77%. This indicates that math problem solving skills are still far from what is expected. After getting 3 students as research subjects who were taken using *Purposive Sampling* technique, then analyzed through their answer sheets and continued with interviews to find out the influencing factors. The following will describe the research results and discussion of the three subjects who have been selected based on the high, medium and low categories. The math problem solving ability questions are as follows.

Problem 1:

In a village there is a square piece of land with a side length of 10m. Mr. Tono intends to make a fish pond on the land with a size of 7 m long and 6 m wide. Around the fish pond Mr. Tono will plant grass. Mr. Tono wants to know how much land is planted with grass?

Analysis on students with high (S-29), medium (S-07) and low (S-18) categories

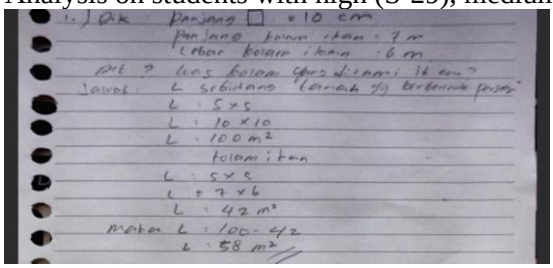

Figure 1
Test Result Number 1 S-29

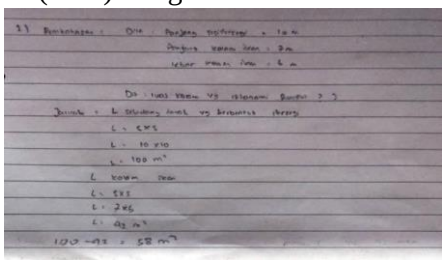

Figure 2
Test Result Number 1 S-07

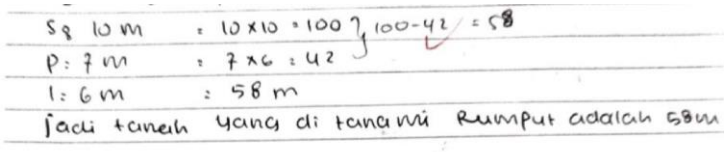

Figure 3
Test Result Number 1 S-18

Based on the written test answers, subjects S-29 and S-07 were able to fulfill the indicators of understanding the problem, making a problem solving plan and solving the problem but did not re-examine the solution or make conclusions from solving the problem. After the interview, the subject mentioned that there was no need to re-examine the solution that had been done because the results were written correctly and clearly. According to (Zulfitri, 2019) the indicator of problem solving ability that often appears is the indicator of understanding the problem, where this indicator appears at every level of student ability, namely high, medium, and low. While the indicator that appears very rarely is the indicator of looking back. The reason this indicator rarely appears is because most students ignore the question prompts to look back, students feel enough with the acquisition of the final results without re-analyzing the results that have been obtained.

Based on the written test answers, subject S-18 has not been able to understand the problem because the subject can only mention what is known. In addition, the subject also did not fulfill the indicator of making a problem solving plan, did not write the problem solving formula due to not understanding the problem properly. The subject was able to complete the problem solving indicators by answering the questions correctly and was able to conclude/interpret the results obtained correctly. After the interview, the subject mentioned that he was hesitant in understanding the problem so that he was less precise in making a solution plan but still able to solve the problem properly without checking

it again. The results of the interview agree with (Aliah & Bernard, 2020) The greatest difficulty experienced by students is at the stage of performing mathematical procedures. This can be seen in the step of determining incomplete problem solving strategies, mistakenly determining plans and even some students are not correct in determining problem solving strategies, some students have difficulty translating problems into mathematical models and students have difficulty understanding problems.

Problem 2:
A rectangle is 25 cm wide and a square with a side length of 10 cm. if the area of the rectangle is 2 times the area of the square, then the length of the rectangle is ?
Analysis on students with high (S-29), medium (S-07) and low (S-18) categories

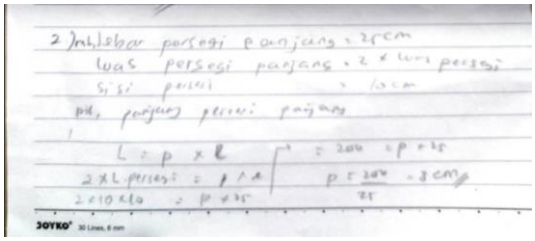

Figure 4
Test Result Number 2 S-29

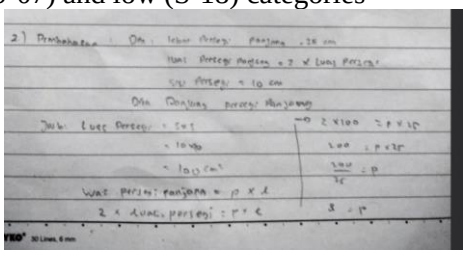

Figure 5
Test Result Number 2 S-07

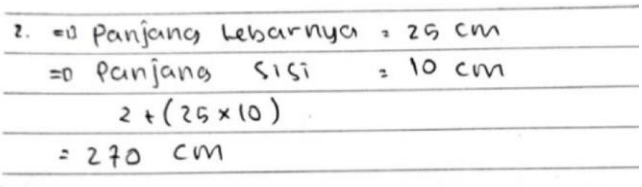

Figure 6
Test Result Number 2 S-18

Based on the written test answers, subjects S-29 and S-07 were able to fulfill the indicators of understanding the problem, making a problem solving plan and making a problem solving plan but did not re-examine the problem solving or make a conclusion from the problem solving. After the interview, the subject mentioned that writing the conclusion was not too important because it was represented by the correct answer. Nurussafa'at et al., 2016 who stated that the mistakes made by students include: (a) assuming that writing what is known is not very important because it is clear what is asked in the problem, (b) according to the subject, the teacher does not really emphasize writing conclusions in working on story problems, (c) considering that writing what is asked will waste time and be more concise if it is not written, (d) not being careful in reading the problem so that it results in mistakes in writing what is known, and (e) forgetting to write the formula completely and rushing to work.

Based on the written test answers, subject S-18 has not been able to understand the problem therefore it can be seen from the incorrect answers starting from writing what is known, writing the solution plan/formula used to the incorrect solution. This is in accordance with the opinion of Noviyanti et al., (2021) which states that students' difficulties, especially in problem solving according to the teacher's view, are due to the difficulty of students understanding the problem, making plans in solving the problem, describing and linking to previous knowledge. In addition, students also have difficulty understanding the sentences listed in the problem, are less familiar with the problems presented and are less able to apply strategies to solve problems.

Problem 3:
The surface of a wall hanging is an isosceles triangle with one side 15 m long and the other side 24 m long. If the height of the wall hanging is 9 m, determine: the perimeter and surface area of the wall hanging?

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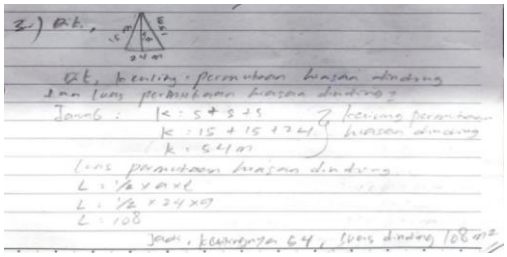


Figure 7
Test Result Number 3 S-29

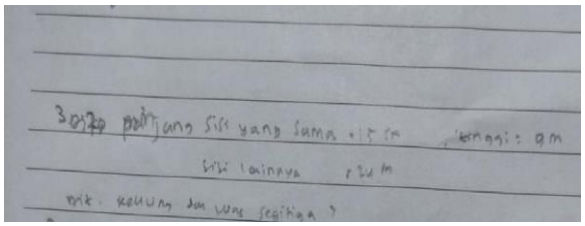


Figure 8
Test Result Number 3 S-07

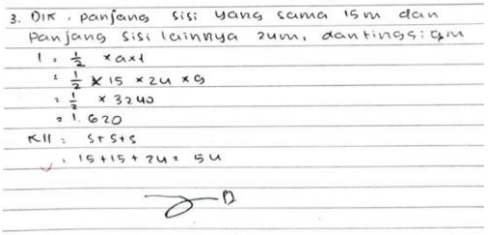


Figure 9
Test Result Number 3 S-18

Based on the written test answers, subject S-29 was able to fulfill all indicators, namely understanding the problem, making a problem solving plan, making a problem solving plan and re-examining the solution or making conclusions from solving the problem. After conducting an interview with the subject, the student confidently mentioned that he understood the problem well and knew how to solve the problem, namely by knowing the formula and applying the formula correctly.

Meanwhile, subject S-07 was only able to fulfill the indicator of understanding the problem, namely being able to write down what was known from the problem. The subject was not able to make a problem solving plan to solve it correctly. Based on the results of the interview with subject S-07, the subject said that from the beginning he did not understand the problem given, namely not being able to describe how an isosceles triangle so that in the calculation process, the subject did not know the steps to be taken. Violita, et al (2021) said that in learning mathematics, especially in problem solving skills, many students still have difficulty solving problems that require problem solving.

Based on the written test answers, subject S-18 seems to be able to fulfill the indicators of understanding the problem and making a problem solving plan but has not been able to solve the problem correctly. This can be seen from the answer that mistakenly entered the numbers in the formula so that the final answer was wrong and did not re-examine the solution or make a conclusion from solving the problem. Anggraeni & Kadarisma (2020) said that many students still make mistakes in solving problems due to unfamiliarity, difficulty in understanding the problem, mistakes in calculating, and not checking the answers obtained.

Problem 4:

A square floor with a side length of 6 m. The floor will be tiled with 30 cm × 30 cm square tiles. determine the number of tiles needed to cover the floor?

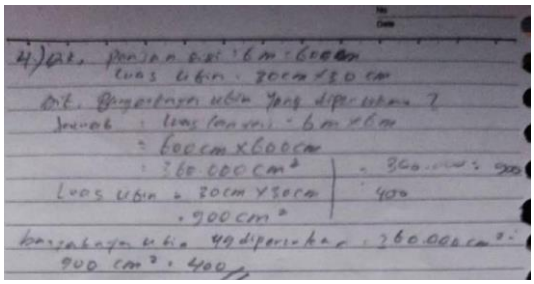


Figure 10
Test Result Number 4 S-29

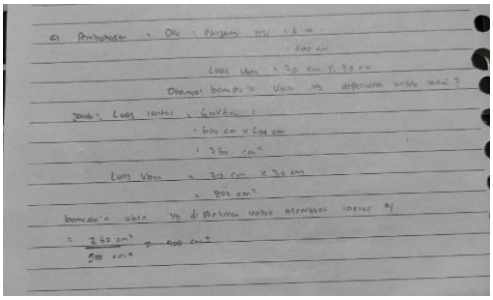


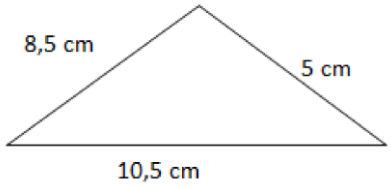
Figure 11
Test Result Number 4 S-07

Based on the written test answers, subject S-29 was able to fulfill all indicators, namely understanding the problem, making a problem solving plan, completing the plan and re-examining the solution or making conclusions from solving the problem. After conducting an interview with the subject, the student confidently mentioned that he understood the problem well, knew the right formula, could use and apply the formula to the problem presented correctly and calculate correctly.

While the subject S-07 was able to fulfill the indicators of understanding the problem, namely being able to write what was known from the problem, being able to make a problem solving plan but the subject solved the problem incorrectly. After the interview, the subject mentioned that he understood the problem well until the solution but because he was less careful and in a hurry so that there was an incorrect calculation part. Resulting in an incorrect final result.

Based on the results of the interview, the subject said that the subject did not understand the problem because he was not used to understanding story problems. This statement is in line with the opinion of Nuryana & Rosyana (2019) that students have difficulty solving problems because they are not used to working on problem solving skills.

Problem 5:
Take a look at the following flat shapes!



What is the area of the figure above?

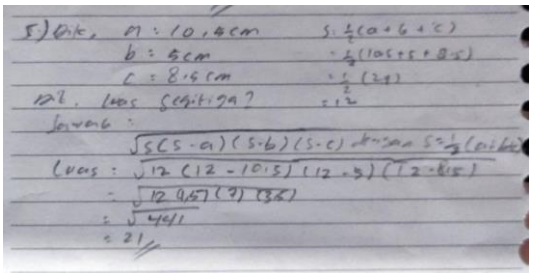


Figure 12
Test Result Number 5 S-29

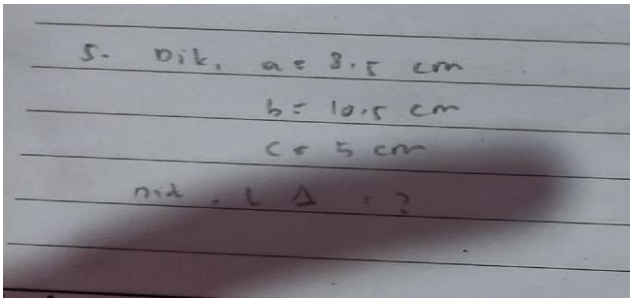


Figure 13
Test Result Number 5 S-07

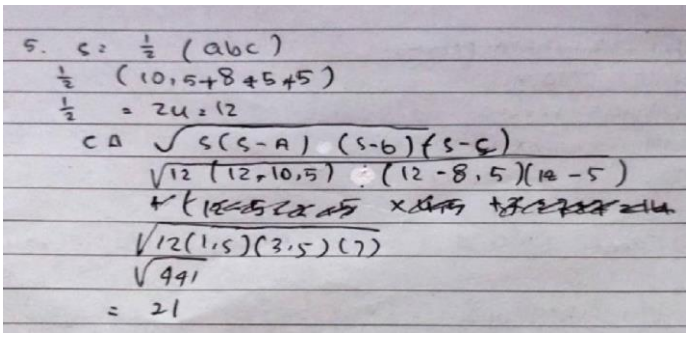


Figure 14
Test Result Number 5 S-18

Based on the written test answers, subject S-29 was able to fulfill all indicators, namely understanding the problem, making a problem solving plan, completing the plan and re-examining the

 Print ISSN: 2088-2157, Online ISSN: 2580-0779

solution or making conclusions from solving the problem. After conducting an interview with the subject, the student confidently mentioned that he was able to understand the problem well, know the right formula, can use the formula correctly and perform the calculation procedure correctly.

Meanwhile, subject S-07 was only able to fulfill the indicator of understanding the problem, namely being able to write down what was known and asked from the problem. The subject did not write a solution plan to solve the problem. In other words, the subject did not answer the problem properly. After the interview, the subject did not know the formula that should be used to solve the problem. According to Ruhyana (2016) students have difficulty applying the right formula in solving problems and are not careful in working on problem solving problems and do not re-examine the answers obtained.

DISCUSSION

The classification of students' abilities, be it high, medium, and low in solving problems on triangle and quadrilateral material, is carried out using assessment categories that focus on students' average scores. Based on the tests and interviews that have been conducted by researchers, the discussion will be explained in accordance with the indicators of students' mathematical problem solving ability as follows:

Problem Understanding Ability

Based on the results of the study, it can be concluded that the ability to understand the problem of each student is different. Students with high and medium problem solving ability categories have a better ability to write and explain the information known and asked from the given problem. When interviewed, students with high and medium abilities were also able to explain clearly the things they knew and asked from the problem. In fact, students with high and medium problem solving ability could explain in great detail how they determined the known information. On the other hand, students with low problem solving ability were only able to write down the known information from the problem, but they were still unable to write down what was asked. This finding is also consistent with the interview results of low ability subjects, where low ability students were only able to explain what was known and give examples of the known information, but they were still mistaken in explaining what was asked. Vygotsky believed that learning occurs when students work or learn to handle complex tasks or problems that are still within the cognitive reach of students or those tasks are in the Zone of Proximal Development (Simamora et al., 2018). Low ability to understand math problems may reflect a lack of understanding of basic concepts. Students can struggle to understand basic mathematical principles, which can affect their understanding of more complex topics. In addition, if students have low problem understanding, they may struggle to develop critical thinking skills, such as the ability to analyze information, make inferences, and formulate solutions.

Making a Problem Solving Plan

Based on the research findings, it is known that the ability to make a problem solving plan for each student varies. Students with high and medium problem solving ability categories were able to write and explain the solution plan that would be used. They can also correctly answer how to solve the problem. On the other hand, they did not record the formula or plan to be used to solve the problem, but when interviewed, they were able to explain the solution plan to be used. Students with moderate problem solving ability sometimes forgot to write down the plan, but they actually understood the solution plan that should be used. The students with low problem solving ability have not been able to write and explain the problem planning process. They did not record the plan that would be used to solve the problem, even when interviewed, students with low ability were unable to explain the solution plan that should be used. To solve a problem, a problem solver can use the strategy or steps formulated by Polya (1973), that is, we must first understand the problem; we must see clearly what is requested. Second, we must see how things are connected, how the unknown is connected to data, to get ideas about solutions, to plan solutions. In problem solving activities during learning the teacher basically serves as a "trainer" for students. Students are asked to "think" more, and create rather than "quote"

material. (Simamora et al., 2018). Furthermore, that 80% of the problem solving success could be explained by the problem solving strategies (Yeliz, 2015). The ability to make plans is part of critical thinking skills. If students struggle to make plans, they may also be underdeveloped in critical thinking skills, such as the ability to analyze information and make rational decisions. In addition, low plan-making ability may reflect a limited understanding of the structure of mathematical problems. Students may have difficulty seeing connections between concepts or developing a logical plan.

Finalizing the Plan

Students who have high problem solving ability have been able to document the process of implementing the plan they have determined. They also showed a higher level of creativity in carrying out the solution process. Through the results of interviews with students in the high ability category, it can be concluded that they understand the steps that need to be taken from the beginning to the end of the solution. Students with high problem solving ability also conveyed confidently the steps of the solution they did.

Students with moderate problem solving ability often make mistakes in the implementation of the problem solving process, even they tend not to realize the mistakes they have made. Based on the interview results, it can be seen that students with moderate ability continued the process of implementing the solution even though the formula they used was actually wrong. In fact, in the process of implementing problem solving, students with moderate ability admit that they are less careful in calculations.

Students with low problem solving ability also often make mistakes in carrying out the problem solving process. Students with low ability are seen more often continuing the solution process from the wrong solution plan and even often leave the problem unanswered. Based on the interview results, it can be revealed that low ability students do not evaluate the process of implementing the solutions they have done. Findings of nationwide research reveal that non-routine problems, and strategies used to solve them, are not introduced to students extensively in textbooks or learning environments (Yeliz, 2015). Low math solving skills can reflect a lack of mastery of fundamental math concepts. Students may have difficulty understanding and applying basic concepts in problem-solving situations.

Rechecking

At the stage of checking back or making conclusions, high ability students sometimes rewrite the final results they have completed, equipped with a sentence reinforcing the statement. Based on the results of the interview, it was revealed that students with high ability sometimes check and revise the answers they have completed, ensuring the solution steps they have applied are correct or not. Students with moderate problem solving ability, they checked and wrote their answers by including reinforcing statements. The interview results showed that students with moderate problem solving ability consistently rechecked the answers they had completed. However, it was found that students often did not realize the mistakes in their solving process, even though they had done the rechecking.

Students with low problem solving ability rarely do back checking. From the answer sheet, it can be seen that students rarely write back the statement sentence as a reinforcement of the answer they have completed. The interview results revealed that students with low ability almost never do back checking after completing the problem solving process. This is due to the students' lack of understanding which makes them feel confused about the results they achieve, so they feel no need to recheck their answers. This finding is in line with research (Kushendri & Zanthy, 2019), which states that students who do not understand the problem tend not to be able to elaborate it well, including in terms of performing suboptimal rechecking. The ability to check back also includes metacognition skills, which is the ability to realize and control their thinking process. If metacognition skills are low, students may have difficulty identifying and correcting their own mistakes.

The impact of low math problem solving skills in education can create significant challenges in the development of students' critical skills, including: 1) limited understanding of mathematical concepts, 2) lack of creative thinking skills, 3) difficulty applying mathematical concepts in real-life situations, 4) decreased participation in learning and developing mathematical skills, 5) affecting students' ability to pursue educational and career paths that require higher-level mathematical skills.

 Print ISSN: 2088-2157, Online ISSN: 2580-0779

To improve math problem solving skills, some suggestions that can be considered are: 1) Integrate contextual learning, 2) apply active learning methods, 3) provide appropriate challenges, 4) provide constructive feedback, 5) involve technology, 6) encourage collaboration and discussion.

CONCLUSION

Based on the analysis that has been done, it can be concluded that the mathematical problem solving ability of seventh grade students of Mts Riyadlotul 'Uqul on triangle and quadrilateral material is still relatively low. This indicates that the ability to understand mathematical concepts is still limited so that it can affect students' ability to apply mathematical concepts in the context of everyday life or in more complex problem situations. The ability to solve math problems in the high, medium and low categories, obtained the highest achievement of students in the four indicators of mathematical problem solving according to Polya is in the indicator of understanding the problem. Students have been able to identify what is known and asked correctly. Meanwhile, the lowest achievement of students is in the indicator of checking back or interpreting the results obtained. The results of the study are expected to provide useful insights for the development of more effective teaching strategies on triangle and quadrilateral materials.

ACKNOWLEDGMENTS

On this occasion the researcher would like to thank all those who have sincerely and sincerely provided motivation and moral and material assistance.

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