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RESEARCH ARTICLE

Analysis Mathematical Thinking Skills in Three-Dimensional Shapes using the Study saster Modle

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ABSTRACT

Mathematical thinking skills are related to mathematical processes or ways of thinking in solving simple or complex mathematical problems. Problem solving in the classroom in this study uses a studysaster model, this model uses 6 stages, namely identification, search, plan, create, share, and practice. The purpose of the research is how students' mathematical thinking skills in solving mathematical problems of three-dimensional shapes material. This research method uses qualitative research using a case study approach. The subject of this study is grade VIII students who have received three-dimensional shapes material. This study aims to determine students' mathematical thinking ability on three-dimensional shapes. The results of this study are that the research instruments used are valid, the results of the validation of the mathematical thinking ability test obtained are more than 80% and for the validation of the interview instrument is obtained more than 60%. Students' mathematical thinking skills in three-dimensional shapes in class VIII have four categories, namely very high, high, medium, and low categories. Students with very high and high category abilities have met all indicators of mathematical thinking ability, students with moderate mathematical thinking skills are still unable to review the results of the answers that have been made, and students with low mathematical thinking skills are only able to complete the indicator of understanding the problem problem, while other indicators have been answered, but not exactly.

1. INTRODUCTION

The results of the 2018 Programme for International Student Assessment (PISA) study place Indonesia still very low (Ferdianto, Latifah, et al., 2022), Mathematics learning emphasizes more on solving mathematical problems, because in reality humans always face problems in their daily lives (Menon & Chang, 2021), One of the skills needed by students is the ability to think mathematically (Soboleva et al., 2020).

This research focuses on mathematical thinking ability on three-dimensional shapes material, mathematical thinking ability in each student is diverse, students' mathematical thinking ability can be categorized into; low math ability, medium math ability, and high math ability (Tall & Witzke, 2020) (Ferdianto, Sukestiyarno, et al., 2022). In line with that (Bradshaw, 2010) said that indicators of mathematical thinking ability include understanding problem problems, planning problem solving formulas, executing problem solving formulas, and rechecking the steps and answers to questions.

The term mathematical thinking is defined as a way of thinking with regard to mathematical processes or ways of thinking in solving mathematical tasks, whether simple or complex (Goos & Kaya, 2020) (Ferdianto, Waluya, et al., 2022). Mathematical thinking ability is an accumulation form of mathematical thinking concepts that indicate the development of abilities (Kooloos et al., 2022).

According to (Ferdianto, Sukestiyarno, et al., 2022) indicators of mathematical thinking ability are:

1. Understanding the problem problem, students can understand or identify the problem from what is already known and what is asked from the problem of the mathematical problem.
2. Planning a formula to solve the problem, students can plan or determine the right formula to solve the mathematical problem.
3. Applying or executing the problem solving formula, students can apply or run the formula according to the plan and perform the calculation operation correctly.
4. Review or recheck the steps and answers of the questions, students can recheck the steps and answers of solving the math problems.

The stages in mathematical thinking are as follows (Bradshaw, 2010)

1. **Entry phase;** Entry Phase work to formulate the right questions and in deciding what to do. When facing a question, it can be done in two ways, namely absorbing the information provided and finding out what the purpose of the question is. Then another activity that often occurs in the initial phase is to make some preparations for the completion phase. In the entry phase, among other things, the process of identifying problems and defining problems is carried out. To make it easier to work in the entry phase, it is by connecting to the question, what is known from the question and what is the purpose of the question. According to (Ferdianto & Ghanny, 2014) expressing understanding refers to the ability to understand and understand something after it is first known or remembered and interpret the material that has been studied.
2. **Attack phase,** The solving phase is the most important part of the mathematical activity that is carried out to solve the problem. In the completion phase, this is done by taking several approaches that can be used as well as formulating and trying out a plan. If the plan has been carried out, then good progress will be made in working to solve the problem. Knowledge of mathematical techniques, principles, or concepts is certainly the main requirement in undergoing this phase. Several things such as intellectual ability, creativity, memory, and skills are also factors that affect success in this phase of completing. (3) Review Phase, The review phase is carried out when a satisfactory solution has been reached or when it is about to give up, so it is important to review the work that has been done. The review phase is useful in reflecting on previous phases. In this phase, it will help to check whether the mathematical thinking process in problem solving is correct and whether the problem can be solved.

In learning activities, a good learning method is needed (Miranda et al., 2021) (Ariastuti & Wahyudin, 2022), The learning method contains directions regarding the design of teaching methods in achieving a complete learning concept with plans, practices, and evaluations (Joyce & Calhoun, 2024) (Munna & Kalam, 2021) (Sarker, 2021). The delivery of materials for building flat-sided spaces can be conveyed optimally and can be easily understood by students through appropriate learning methods. One of the learning methods is the studysaster, the studysaster model has five learning steps, namely identification, search, plan, create, share, and practice (Widyasari, 2020) (Nugroho & Winarno, n.d.).

This research is very necessary because one of the abilities that must be possessed by students is the ability to think mathematically which is useful not only to solve mathematical problems, but also to be able to solve everyday problems as well.

2. RESEARCH METHOD

Research design

This research uses a qualitative research method with a case study approach, the research is focused on one phenomenon that is selected and wants to be understood in depth, namely about students' mathematical thinking ability in solving mathematical problems. (Creswell, 2014) It states that qualitative research is a method of exploring and understanding meanings derived from humanitarian problems. According to (Hidayat & Purwokerto, 2019) A case study is a series of scientific activities that are carried out in an intensive, detailed, and in-depth manner about an event, program, and activity, either at the level of an individual, a group of people, an institution or an organization to gain in-depth knowledge about an event.

Research target/subject

The subject of this study involved junior high school (SMP) grade VIII students who had received three-dimensional shapes mathematics learning materials, from the results of test sheets and teacher considerations as many as three grade VIII students, namely one student with high-level mathematical thinking skills, one student with medium-level mathematical thinking skills, and one student with low-level thinking skills.

Research procedure

The instrument validation test that will be used in this study to three validators, namely with two from lecturers and one from teachers about mathematical thinking skills on three-dimensional shapes material. The validation sheet contains the language on the instrument, conformity with the indicators, and instructions for working on the test sheet (Mohamad et al., 2015) (Taherdoost, 2016). Testing in the scope of education is a term used to measure the learning outcomes of students after experiencing learning activities (Rahardja et al., 2019), The instruments on the test sheet consist of two math problems with three-dimensional shapes that refer to the ability to think mathematically according to (Bradshaw, 2010). The interview guideline instrument contains questions about how the subject solves math problems from the test sheet.

Instruments, and data collection techniques

The instruments contained in this study are test sheets and interviews. Mathematics test sheets that are in accordance with the indicators of mathematical thinking ability according to (Bradshaw, 2010). The scoring guidelines for test sheets are used according to modified ones to assess students' mathematical thinking skills, the next instrument is an interview, in the interview instrument contains questions that include how the process of solving mathematical problems carried out by the research subject. The questions in the interview guidelines are adjusted to indicators of mathematical thinking ability (Jailani, 2023).

The first data collection of this study uses a test sheet consisting of two mathematical problems of three-dimensional shapes material that refer to mathematical thinking skills according to (Bradshaw, 2010). After the students' test sheet scores were known, three students were selected consisting of one student with high mathematical thinking skills, one student with moderate mathematical thinking skills, and one student with low mathematical thinking skills. Furthermore, the six students were interviewed how to solve the problem of the math problem in accordance with the interview guidelines according to (Hidayah et al., 2018). Interviews are an important study of human interaction, so interviews can be a tool that can socialize both parties (Syamsudin, 2014).

Data analysis technique

The data analysis techniques used according to (Miles et al., 2019) which consists of data reduction, data presentation, and conclusion drawn. This data reduction summarizes, selects and focuses on the things that matter. Thus, the data that has been reduced can provide a clearer picture and make it easier for research to collect further data. The presentation of this data can be organized and arranged in a relationship pattern so that the data is easy to understand, with the presentation of this data will make it easier to understand what is happening, plan the next steps based on what has been understood. In the step of drawing this conclusion, it will answer the formulation of the problem that has been formulated from the beginning,

3. RESULTS AND DISCUSSION

Instrument validation

Before using the instruments in this study, instrument validation was carried out first, the validation sheet of this research consisted of test validation sheet instruments and interview instrument validation sheets. The validator consists of two lecturers and one subject teacher at the place where the researcher conducts the research. The results of the validation of the mathematical thinking ability test sheet can be seen in Table 1.

Table 1: Validation of the mathematical thinking ability test sheet for material students three-dimensional Shapes

No	Validator	Aspects			Score
		Content	Construction	Language	
1	Lecturer 1.	9	17	8	85%
2	Lecturer 2	9	17	8	85%
3	Teacher 1	8	19	9	90%

Table 1 shows the results of the validation sheet of the test sheet instrument of the question sheet, it is obtained that the test sheet instrument of this research question is valid and can be tested on the research subject, because the score of the validation sheet is above 80% where the research instrument is valid.

In the results of the validation sheet of this test sheet instrument, validator 1 gave a score of 85% and provided input that there were no instructions for filling out the mathematical thinking ability test sheet according to the steps of the mathematical thinking ability indicator. Validator 2 gave a score of 85% by entering that there were still no pictures on numbers one and two on the mathematical thinking ability test sheet, and validator 3 gave a score of 90%, by including pictures on questions number one and two on the mathematical thinking ability test sheet was not large.

Table 2: Validation of interview instruments

No	Validator	Aspects		Score
		Content	Construction	
1	Lecturer 1.	9	12	84%
2	Lecturer 2	8	12	80%
3	Teacher 1	9	13	88%

In Table 2, it can be seen that the results of the validation sheet of this research interview instrument are valid and can be tested on the research subject, because the score of the validation sheet is above 60% where the research instrument is valid. In the results of the validation sheet of this interview instrument, validator 1 gave a score of 84%, validator 2 gave a score of 80%, and validator 3 as a Mathematics Teacher of SMPN 1 Depok gave a score of 88%.

Mathematical thinking skills

The mathematical thinking ability test sheet was carried out at the beginning of the research, the test was used to determine the students' mathematical thinking ability on three-dimensional shapes material. There are two questions with a score weight of 40 and a score weight of 60 which refers to students' mathematical thinking skills.

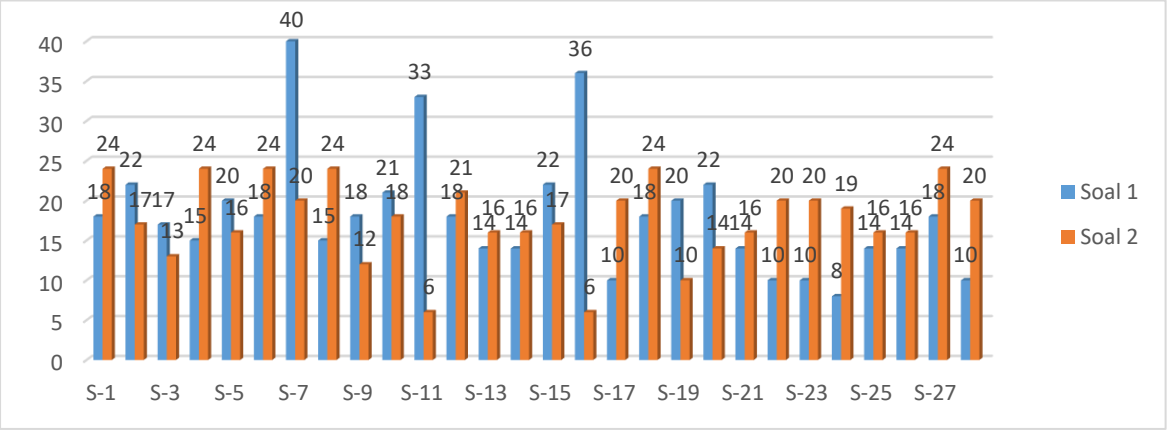


Figure 1: Results of students' mathematical thinking ability test

Figure 1 shows that question number one gets the three highest scores for S-7, namely 40, S-16 36, and S-11 gets a score of 33. The lowest score on question number one is 8 for S-24. Meanwhile, in question number two, the result is smaller than the result number one. The highest score was only 24, but there were 6 subjects who achieved this score. As for the lowest score, a score of 6 was obtained, for S-11 and S-16.

Table 3: Categorization of students' mathematical thinking skills

Category	Score	Percentage (%)	Total
Very High	X ≥ 46,31	3,6	1
High	39,29 < X < 46,31	17,8	5
Medium	32,27 < X < 39,29	32,2	9
Low	25,25 < X < 32,27	46,4	13
Very Low	X < 25,25	0	0

Table 3 shows that the mathematical thinking ability of students in grade VIII of junior high school consisting of 28 students, the very high category obtained 3.6%, which means that there is one student who can meet all the indicators of students' mathematical thinking ability, namely understanding problem problems, planning problem problems, running problem solving formulas, and reviewing. The high category obtained 17.8%, which means that there are five students who can meet all indicators of students' mathematical thinking skills, namely understanding problem problems, planning problem problems, and running problem solving formulas. For the medium category, 32.2% was obtained, which means that there were nine students who met two indicators, namely understanding the problem and planning the formula of the problem. While the low category obtained 46.4%, which means that thirteen students could only meet the indicator of understanding the problem problem, and the very low category obtained 0%, which means that there were no students in that category.

After obtaining the results of the students' mathematical thinking ability test sheets on the three-dimensional shapes material, three students were selected to be used as research samples consisting of one student with high mathematical thinking skills, one student with medium mathematical thinking skills, and one student with low mathematical thinking skills. The three students were interviewed to get data on how the process of answering or solving the questions. The selection of the subject is seen from the results of their mathematical ability and certain considerations by the mathematics teacher in grade VIII. The three students of this study who will be the subjects of the interview are S-7 students with high mathematical thinking ability scores, S-2 students with moderate mathematical thinking.

Very high mathematical thinking ability

Question number one

Subject S-7 answer to question number one on the indicator of understanding the problem.

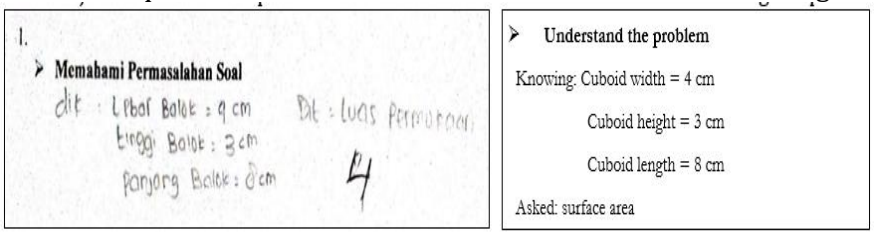


Figure 2: Answer S-7 indicator of understanding problem problems

In Figure 2, the subject S-7 has been able to understand and identify problem number one, namely calculating the surface area of three-dimensional shapes, cubes, and cuboids. The subject wrote what was known in the question, namely the cuboid width of 4 cm, the cuboid height of 3 cm, and the length of the cuboid of 8 cm. Students also write down what is asked in the question, namely what is the surface area of the three-dimensional shapes.

P: How do you understand this problem?

S-7: I got it from reading about Sir, cuboid width is 4 cm, cuboid height is 3 cm, and cuboid length is 8 cm.

P: Then what is asked in question number one?

S-7: The surface area is sir.

In the indicator of planning the formula for solving the problem, S-7 can already plan the right formula or strategy to solve the problem of the mathematical problem. has been able to write down

the correct cuboid and cube surface area formula, namely the cuboid surface area $2 \times (p \times l + l \times t + t \times p)$ and the surface area of the yait cube $6 \times (s \times s)$, seen in the Picture 3.

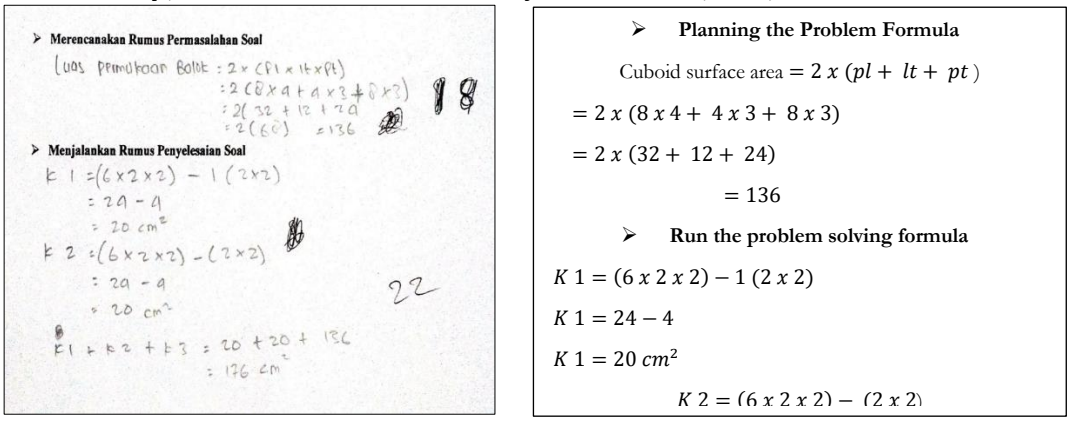


Figure 3: Answer S-7 indicator of planning problem formula

In Figure 3, it can be seen that the subject of S-7 can write down the steps to solve the problem systematically according to the information and formula that has been obtained beforehand, showing that the S-7 is able to carry out the formula for solving the problem correctly and precisely. Students have understood the problem in problem number one, which is to calculate the surface area and run by dividing three-dimensional shapes into three, namely cuboid, cube 1, and cube 2.

P: After determining the solution formula, how do you take steps to solve problem number one?

S-7: I divided it into three first cuboids, cube 1, and cube 2, Sir.

P: Next, how can the result be like this?

S-7: I input the values of the width, height, and length of the cuboid from the problem into the formula for the surface area of the cuboid, Sir.

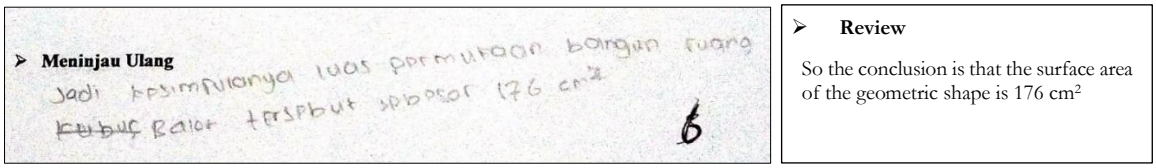


Figure 4: Answer S-7 review indicator

Figure 4 shows that the answer to S-7 is correct and correct, because S-7 is able to understand the problem and carry out the solution formula correctly, then the answer is correct. The subject has re-examined the answers obtained, namely 176 cm²

Question number two

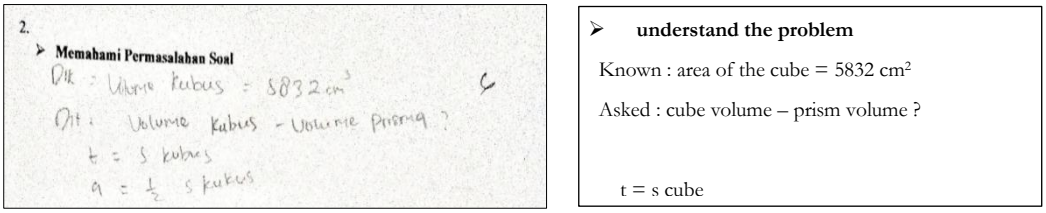


Figure 5: Answer S-7 indicator of understanding problem problems

In Figure 5, the subject of S-7 has written the information in question number two, but S-7 still does not understand the problem. The subject can only write known and asked according to what is contained in the question, because the question already has a cube volume and is asked about the cube volume minus the volume of the prism. In the indicator of planning the formula for solving the S-7 problem, you can plan the right formula or strategy to solve the problem of the math problem.

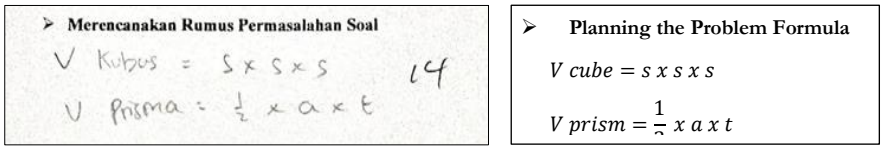


Figure 6: Answer S-7 indicator of planning problem formula

Figure 6 shows that the subject has written the cube volume and prism volume formulas correctly, and the subject also knows why they use these formulas. Because from the problem that the subject reads the question about the volume of the cube minus the volume of the prism, so write the formula for the volume of the cube and the volume of the prism. In the indicator of running the problem solving formula, the subject cannot write down the steps to solve the problem systematically according to the information and formula that has been obtained beforehand. For the review indicator, the same subject cannot understand the problem and carry out the solution formula correctly.

High mathematical thinking ability

Question number one

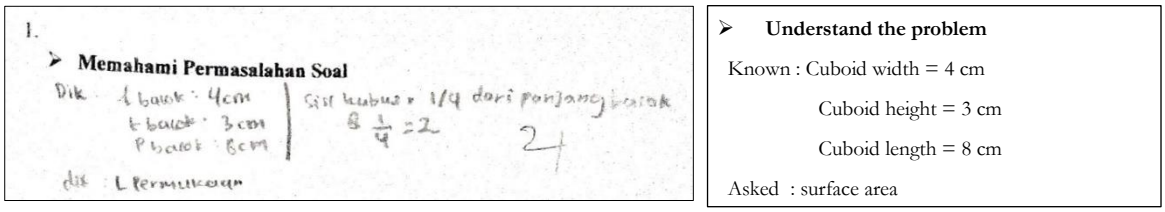


Figure 7: Answer S-16 indicator of understanding problem problems

In Figure 7, it can be seen that the subject S-16 is able to understand and identify the problem number one, namely about three-dimensional shapes cube and cuboid, the subject writes what is known in the problem, namely the height of the cuboid is 3 cm, the width of the cuboid is 4 cm, and the length of the cuboid is 8 cm.

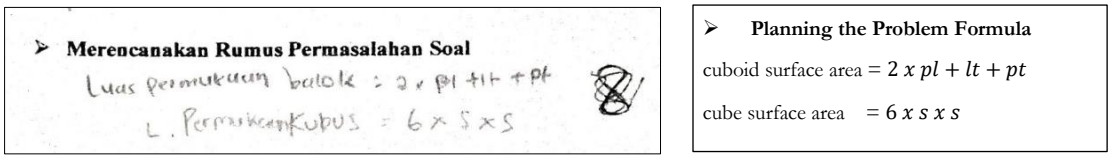


Figure 8: Answer S-16 indicator of planning problem formula

In Figure 8, it can be seen that the subject is able to write the cuboid surface area formula and the cube surface area formula. So that the indicator indicator of planning the problem formula is achieved.

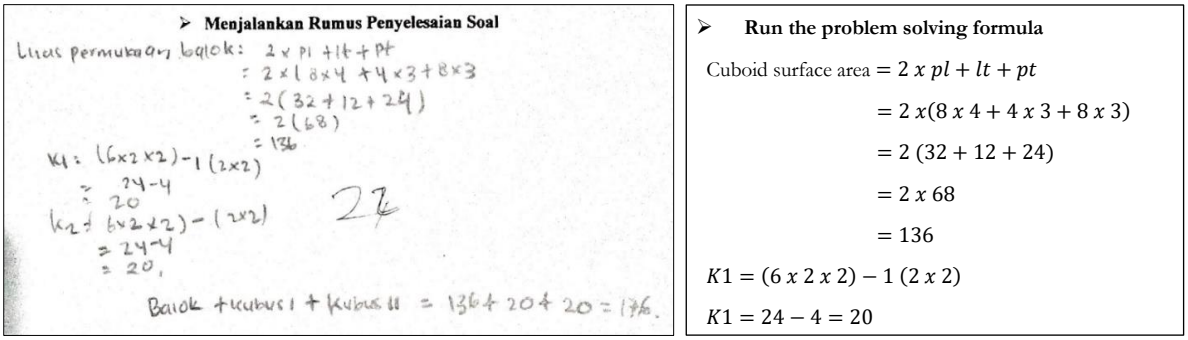


Figure 9: Answer S-16 indicator of running problem solving formula

In Figure 9, the subject is able to carry out the formula for solving problem number one correctly and precisely. I have understood the problem that exists in problem number one, which is to calculate the surface area and run by dividing three-dimensional shapes into three spatial shapes, namely cuboid, cube 1, and cube 2.

P: After determining the solution formula, how do you take steps to solve problem number one?

S-16: I divided the building of the space into three, namely cuboids and two cubes Sir.

P : Then how can this result be obtained?

S-16: I entered the value that has been obtained according to the building of the space, sir. It is already known the length, width, and height of the cuboid so it just needs to be included in the formula Sir, the same as the cube.

P : Where can the results come from?

S-16: Build the space is summed up Sir, cuboid + cube 1 + cube 2.

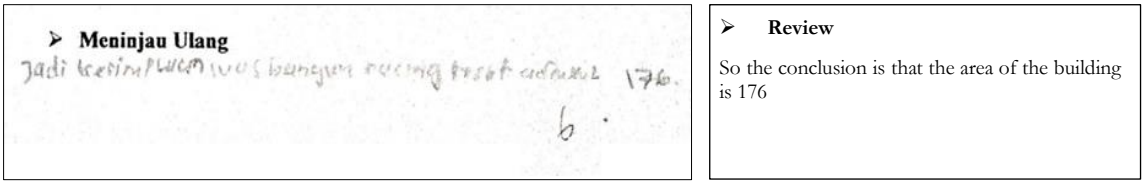


Figure 10: Answer S-16 review indicator

In Figure 10, it can be seen that the answer to S-16 is correct and correct, because S-16 is able to understand the problem and carry out the solution formula correctly, then the number one answer of S-16 is correct. The subject has re-examined the answers obtained, namely 176 cm^2

Soal nomor dua

Figure 11: Answer S-16 indicator of understanding problem problems

In Figure 11, it can be seen that S-16 is not able to understand the problems that exist in the problem, only knowing the information from reading the problem. S-16 does not understand the problem in question number two.

In questions with indicators of planning the formula for the problem problem, the subject has not been able to plan the right formula or strategy to solve the problem problem. The subject has not been able to write down the cube volume and prism volume formulas correctly. The same as in the indicator of running the problem solving formula, the subject cannot write down the steps to solve the problem systematically according to the information and formula that has been obtained previously so that the problem in the problem can be solved and get the right answer. Because they do not understand the problems that exist in the problem. Likewise, on the revisiting indicator, the subject cannot write the conclusion of solving the problem.

Moderate mathematical thinking skills

Question number one

The following are the answers of S-2 subjects which are classified as medium mathematical thinking skills.

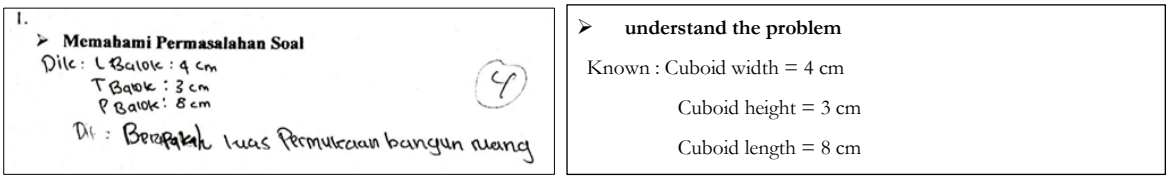


Figure 12: Answer S-2 indicator of understanding problem problems

In Figure 12, it can be seen that S-2 is able to understand and identify problem number one, which is about three-dimensional shapes cube and cuboid, writing down what is known in the problem,

namely the width of the cuboid is 4 cm, the height of the cuboid is 3 cm, and the length of the cuboid is 8 cm. Students also write down what is asked in the question, namely what is the surface area of the three-dimensional shapes.

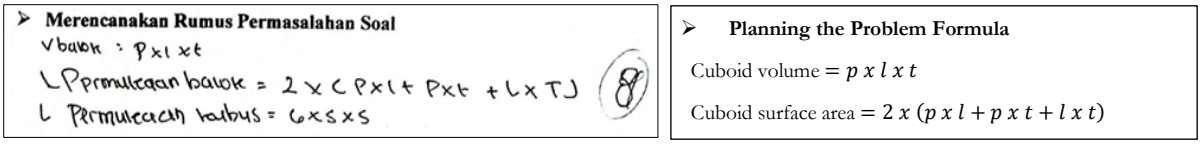


Figure 13: Answer S-2 indicator of planning problem formula

In Figure 13, it can be seen that S-2 is able to write the cuboid surface area formula and the cube surface area formula, the subject can plan the right formula or strategy to solve the mathematical problem. Subjects can write down the formulas needed to solve the problem problem. Formulas needed to answer questions.

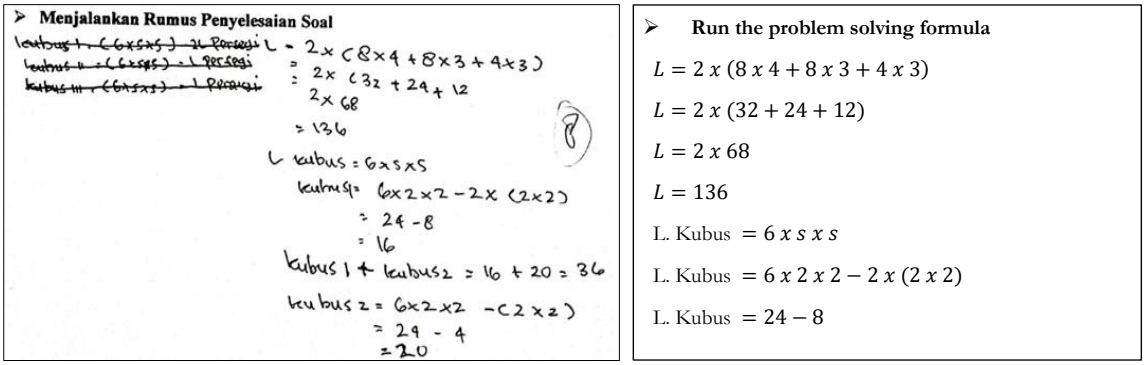


Figure 14: Answer S-2 indicator running problem solving formula

In Figure 14, it can be seen that S-2 has understood the meaning of the problem, but there is a mistake in the second cube space building, because it does not understand the problem of the problem.

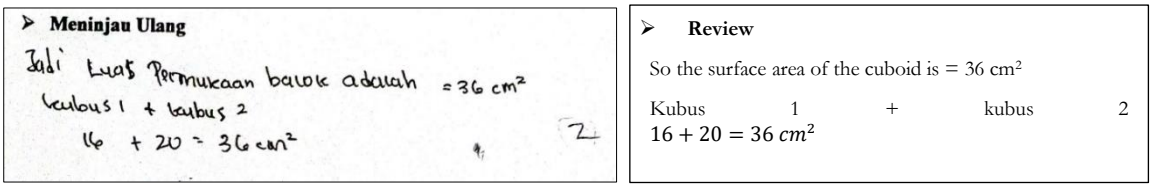
P: After determining the formula, how do you solve this problem?

S-2: I go into the Sir's formula, into the surface area and cuboid formula.

P: This is why cube 1 and cube 2 have different values?

S-2: According to my understanding, sir, there is a cube side that is integrated with the cuboid space. The side of the cube is subtracted from the surface area of the cube so there is one side of the cube reduced and two sides of the cube reduced.

Subject (S-2) is less able to carry out the problem solving formula, because S-2 does not understand the picture on the problem. The subject misunderstands the purpose of the problem, therefore the indicator of solving the problem is not appropriate.



In Figure 15, the S-2 answer is not correct, because the subject is not able to carry out the problem solving formula correctly. The subject did not re-check the completion step and the answer, because he immediately deduced from the answer he worked on.

Question number two

The following are students' answers in the indicator of understanding the problem.

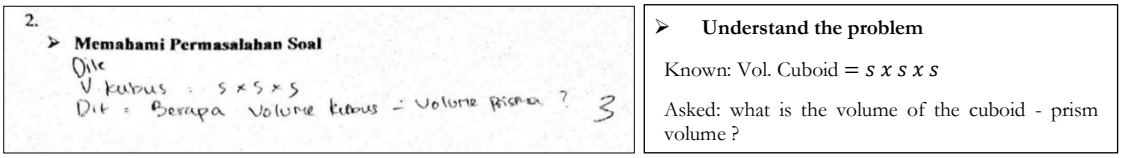


Figure 17: Answer S-2 indicator of understanding problem problems

In Figure 17, the subject writes what he knows and what is asked from the question, is not completely correct in answering, still does not understand the purpose of the question, how and only finds information from reading the question.

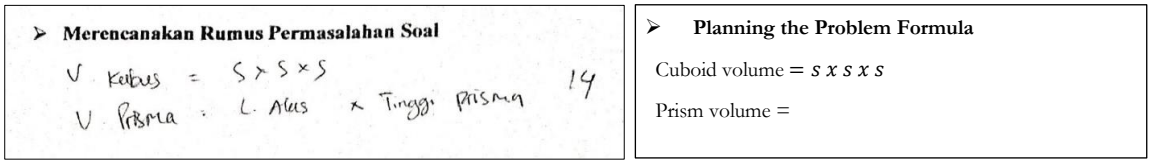


Figure 18: Answer S-2 indicator of planning problem

In Figure 18, it can be seen that the subject is able to write the formula of the problem to answer the problem, namely the cube volume formula and the prism volume formula. S-2 has met the indicators of planning problem problems, it can be seen that the subject is able to write the cube volume formula and the volume prism that will be used to solve the problem problem. Meanwhile, in the indicator of running the formula for solving the problem, the subject does not answer the question, because the student (S-2) does not understand the problem in the question. Just like in the review indicator, the subject has not been able to understand the problem at hand.

Low mathematical thinking ability

Question number one

The following is the answer to question number one of the S-17 subject.

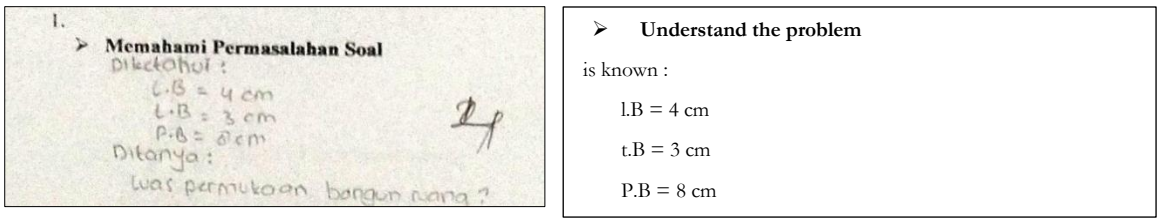


Figure 19: Student answers (S-17) indicators of understanding problem problems

In Figure 19, it can be seen that S-17 is able to understand and identify the problem that exists in problem number one, which is about the combination of three-dimensional shapes cube and cuboid, for problem number one is to calculate the building surface area of cube and cuboid space. The subject wrote what was known in the question, namely the cuboid width of 4 cm, the cuboid height of 3 cm, and the length of the cuboid of 8 cm. The subject also wrote what was asked in the question, namely what is the surface area of the three-dimensional shapes.

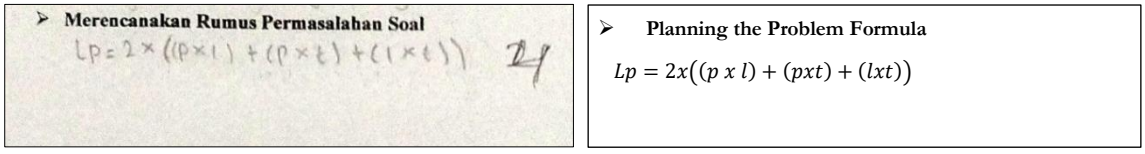


Figure 20: Answer S-17 indicator of planning problem formula

In Figure 20, students are only able to write the formula for the surface area of the cuboid space correctly and do not write the formula for the surface area of the cube space. From the interviews with the students above, the results of the indicator of planning the problem formula for students (S-17) are still incapable of planning the problem formula that will be used in number one. The subject's answer to the indicator runs the problem solving formula, the subject is unable to run the problem solving formula or perform the calculation operation correctly, because he does not remember the cube surface area formula.

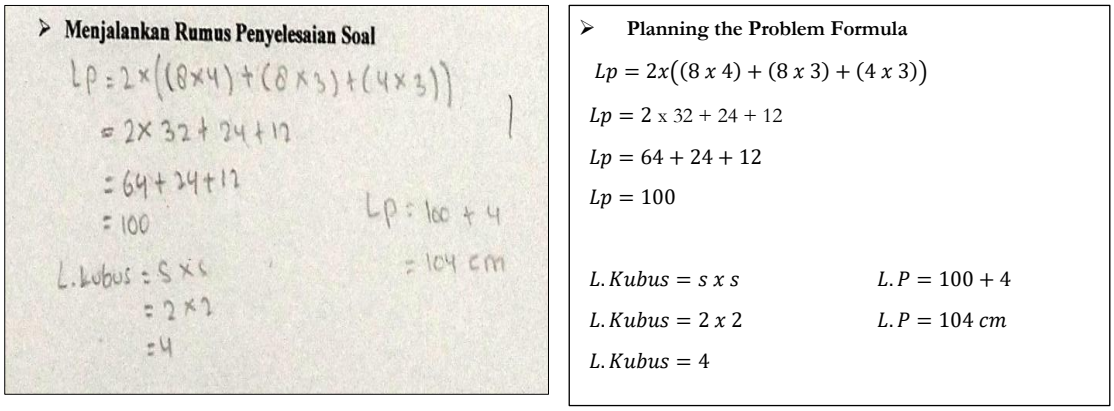


Figure 21: Answer S-17 indicator of running the problem solving formula

Figure 21 shows that initially the subject correctly wrote the cuboid surface area formula, but it was still not correct to complete the calculation operation and the subject could not run the cube surface area formula. This is supported by the results of interviews conducted.

P: After determining the formula, how do you carry out the steps of the formula to solve this problem?

S-17: I just enter the number into the formula for the surface area of the Pak cuboid, then calculate it and the result 100.

P: How can you get cuboid surface area 100?

S-17: I immediately Sir, so 2 x 32 + 24 + 12 = 100.

P: Why not complete the parenthetical calculation operation first ?

S-17: I don't understand, sir, I calculated it like that.

P: Well, if this is s x s it means the cube surface area formula?

S-17: Yes, sir, but I don't know if it's true or not, so I'll just write it.

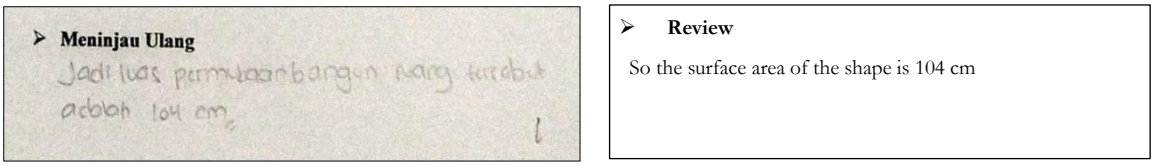


Figure 22: Answer S-17 review indicator

In Figure 22, it can be seen that the answer to number one is not correct, because the subject cannot carry out the problem solving formula correctly, the subject does not check the solution step and the answer to the question, but immediately concludes the answer.

Question number two

The following is the answer of the subject (S-17) in answering question number 2.

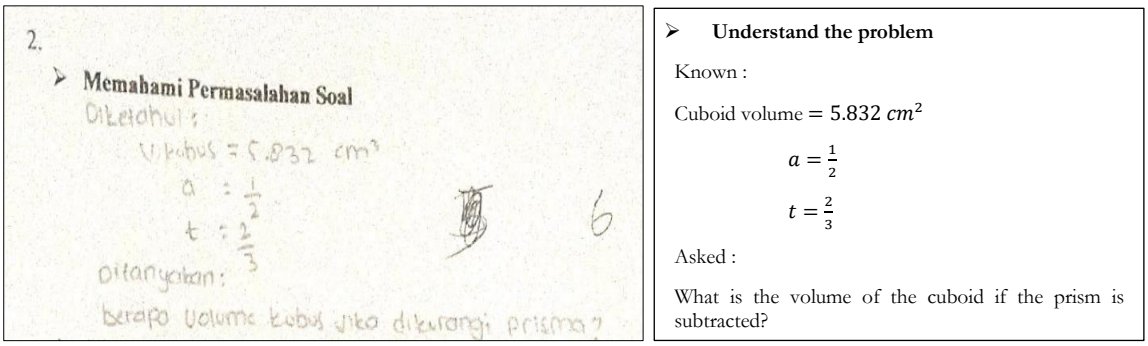


Figure 23: Answer S-17 indicator of understanding problem problems

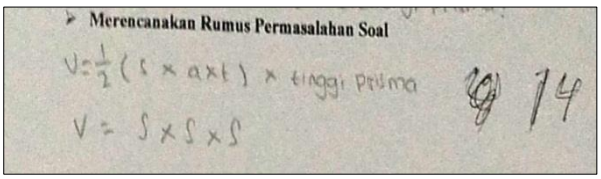
In Figure 23, the subject is unable to understand or identify the problem of the question on the test sheet number two. Students only know from reading the questions, such as what is known from the questions and asked from the questions. Therefore, students only write down what is known and asked from reading the questions.

P: How do you understand the problem of number two?

S-17: I don't understand the meaning of the question of how Sir.

P: Continue to be able to write down where this is known and asked from?

S-17: I wrote that I knew and was asked from reading about Sir, I didn't understand the meaning of the question so I wrote down what I read from question number two, Sir.



➢ **Planning the Problem Formula**

$V = \frac{1}{2}(s\ x\ a\ x\ t)\ x\ prism\ height$

$V = s\ x\ s\ x\ s$

Figure 24: Answer S-17 indicator of planning problem formula

In Figure 24, the subject is able to write down the prism and cube volume formula correctly because the subject sees the cube and prism images. So that the subject has met the indicators of planning the problem formula. The indicator of running the formula for solving the subject problem is not able to understand the problem that exists in the problem, because to carry out the formula for solving the problem is not only a formula is needed, but it is also needed to understand the problem. Similar to the indicator of reviewing the subject not filling in the answer, after the interview, it turned out that the subject still did not understand question number 2. So they can't solve the problem.

4. DISCUSSION

This study analyzes students' mathematical thinking ability using test questions and interviews, previously the validation of the instrument used, the results of the validation of the mathematical thinking ability test of the research instrument are valid (Riduwan, 2012). In the validation sheet of the interview instrument, the mathematical thinking ability part of the content of the interview guidelines is in accordance with the formulation of the research problem, but the questions in the interview guidelines are still not perfect to answer all the objectives of this research. As for the construction of the question items, it is easy for students to understand, but it is not very easy for students to understand. The results of this scoring were obtained from the scoring rubric of the validation sheet modified from (Ulya et al., 2017).

The results of students' mathematical thinking skills in the three-dimensional shapes material got an average score of 35.78, obtained in four categories, namely the very high category, the high category, the medium category and the low category. The results of the research are that many students still have low categories, this can hinder teaching and learning activities. Students who have low thinking skills can cause the student learning process to not be achieved perfectly.

Students with very high mathematical thinking skills are only one student, while students with high mathematical thinking skills there are five students, the subject has been able to carry out the problem solving formula correctly so that he is able to answer the number one question according to the student's mathematical thinking ability indicators according to (Bradshaw, 2010). Aligned with research results (Firdaus & Ni'mah, 2020) (Nindyasari, 2016), and (Alfina, 2017) Explain that students with very high or high categories are able to meet all indicators of mathematical thinking ability from understanding problems, writing problem formulas, running solution formulas, and reviewing the problem. Opinion (Shodikin et al., 2021) said that students have difficulty in doing problems because students are not careful in reading and understanding sentence by sentence and know what they know, are asked, and how to solve problems.

The mathematical thinking ability of students who are in the medium category is nine students, the subject is still not able to carry out the indicator of running the problem solving formula, still wrong

in carrying out the mathematical calculation operation. (Alfina, 2017) in his research, it was stated that students who were in the medium category were still lacking in completing the steps to solve the problem correctly so that they produced inaccurate answers. In line with that (Firdaus & Ni'mah, 2020) and (Nindyasari, 2016), students are still not appropriate in solving these problems.

Students who have low mathematical thinking skills as many as three students, the subject has not been able to carry out the solution formula correctly, is still incapable of performing mathematical calculation operations correctly. in reviewing. This is similar to the opinion (Ramdhani et al., 2017) stated that students with low mathematical thinking skills are quite able to understand the problem problem, but are still not able to write the problem plan correctly and carry out the solution formula correctly, and have not been able to review the steps to solve the problem.

5. CONCLUSION

The conclusion obtained from this study is that the research instrument used is valid, the validation results of the mathematical thinking ability test obtained are above 80% and for the validation of the interview instrument obtained above 60%. Students' mathematical thinking skills in three-dimensional shapes in class VIII have four categories, namely very high, high, medium, and low categories. Students with very high and high category abilities have met all indicators of mathematical thinking ability, students with moderate mathematical thinking skills are still unable to review the results of the answers that have been made, and students with low mathematical thinking skills are only able to complete the indicator of understanding the problem problem, while other indicators have been answered, but not right.

Author contributions

Conceptualization, Ferry Ferdianto and Yohanes Leonardus Sukestiyarno; Methodology, Ferry Ferdianto; Formal Analysis, Widowati, and Iwan Junaedi; Investigation, Yohanes Leonardus Sukestiyarno and Iwan Junaedi; Resources, Ferry Ferdianto; Data Curation, Widowati; Writing – Original Draft Preparation, Ferry Ferdianto; Writing – Review & Editing, Riyan Hidayat; Visualization, Iwan Junaedi; Supervision, Yohanes Leonardus Sukestiyarno; Project Administration, Ferry Ferdianto and Iwan Junaedi.

Conflicts of interest

The author(s) declare no conflict of interest

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