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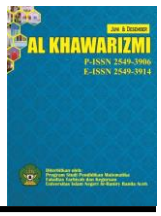

THINKING PROCESS OF STUDENTS OF MTs DARUL HIKMAH IN MATHEMATIC PROBLEM SOLVING ON THE MATERIAL OF FLAT SIDE SPACE BUILDING REVIEWED FROM ADVERSITY QUOTIENT

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Abstract

This study aims to describe the thinking process of MTSs Darul Hikmah students in solving mathematical problems in flat side space building materials reviewed from Adversity Quotient. This study uses a descriptive type of research with a qualitative approach. The research began by providing an adversity response profile (ARP) questionnaire to 25 students in grade IX of MTSs Darul Hikmah. From these results, two subjects were obtained consisting of one climber and one camper subject. Furthermore, the two subjects were given problem solving test questions twice using flat-sided space building materials to measure students' thinking processes. Data collection was carried out through tests and interviews, while data analysis used qualitative data analysis techniques, namely data reduction and data presentation as well as drawing conclusions from each adversity quotient group. The results of the study show that the thinking process of MTsS Darul Hikmah students based on the adversity quotient in the climbers and campers categories has the same thinking process, namely the conceptual thinking process in solving mathematical problems in the building material of flat side spaces.

INTRODUCTION

Mathematics is closely related to problem solving (Davita & Pujiastuti, 2020) Mangelep, Mahniar, Nurwijayanti, Yullah, & Lahunduitan (2024) stated that solving

problems requires adequate understanding and knowledge, as well as having a variety of strategies that can be chosen when facing different problems. Problem-solving skills for students need to be pursued so that students are able to find solutions to various problems, both in the field of mathematics and problems in everyday life that are increasingly complex (Lestari & Andinny, 2023) Hafidz, Kusumaningsih, & Aini (2019) define problem-solving skills as an individual's means of using pre-owned knowledge and abilities to be synthesized and applied to new and different situations.

Thinking is always related to problems arising from the present, the past and perhaps problems that have not yet occurred. The problem-solving process is called the thinking process (Ahmadi, 2009) The thought process is a mental activity or a process that occurs in the student's mind when the student is faced with a new knowledge or a problem that is happening and seeks a way out of the problem. Yani, Ikhsan, & Marwan (2016) stated that the thought process is an activity that occurs in the human brain. Saefudin (2011) also stated that the thinking process is a process that begins by receiving data, processing and storing it in memory which is then retrieved from memory when needed for further processing. The thinking process in learning mathematics is a mental activity that exists in the minds of students, so Maryanti & Qadriah (2021) stated that to find out how students' thinking processes can be observed through the process of how to do tests and results written in order. In addition, it was coupled with an in-depth interview about how it works.

One of the difficulties faced by students in learning mathematics is in solving geometry problems (Fauzi & Arisetyawan, 2020) At the stage of the process of solving problems about geometry, students are required to think in solving them. The various ways that students do to solve problems in mathematics subjects is a problem that must be studied more deeply. As educators, this must be realized and comprehensively understood about how students understand and work on the problem of building a flat side space (Wardhani, 2022) Polya (1973) offers a problem-solving strategy consisting of four steps, namely understanding the problem, devising a plan, carrying out the plan, and looking back. In solving problems, the thinking and approach used in the solution process are more important than the answers obtained, in other words, how the results are achieved are much more important (Mayer et al., 1995) With such belief, it is hoped that there will be a sincerity to be more sensitive and careful in trying to find and develop the potential that students have in learning mathematics (Mulyadi & Muhtadi, 2019)

Facts in the field show that teachers lack training or accustoming to the thinking process in mathematics learning. Mathematics learning is only seen as a monotonous and procedural activity, namely the teacher explains the material, gives examples, assigns students to work on practice problems, checks students' answers at a glance, and discusses problem solving (Mukhtasar et al., 2018)

The results of the preliminary study showed that students made mistakes in using the pruning operation. This error causes students to make mistakes in determining the value of "s" or the length of the sides of the cube, thus impacting each of the two cubes in question. In addition, students also make mistakes in understanding the size of the width and height of the beams, as shown in figure 1

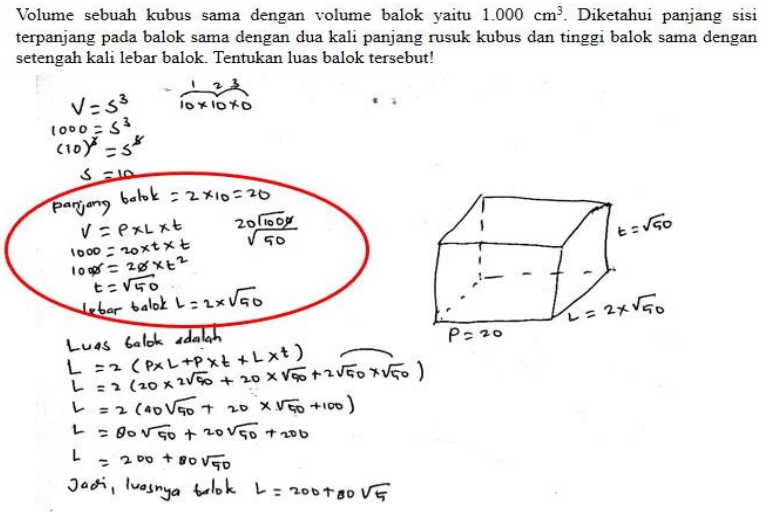

Figure 1 Student work

Students make mistakes in understanding the size of the "width" and "height" of the blocks, causing students to make mistakes in determining the actual width of the blocks. This error also results in errors in making sketch sizes and also subsequent calculations.

The results of the students' work above show that the students have not been able to solve the given problem. What is an indication that students already understand the problem? Is the problem-solving plan that the students have created adequate? Is the implementation of the problem-solving plan carried out by the students appropriate? And is the solution to the problem obtained by the students communicated correctly? The success of students in solving problems is certainly inseparable from the efforts of their teachers in training their problem-solving skills (Ulfa & Roza, 2022)

Some teachers believe that problem-solving skills develop automatically from mastery of numeracy skills. According to Lenchner (2005), this is not entirely true. Problem solving is a skill that needs to be taught and teachers must strive for it. These efforts can be made through learning comprehensive problem-solving skills, which include steps or strategies in solving problems.

Students' problem-solving abilities are different influenced by their thinking ability. Thinking ability is known as Adversity Quotient which means a person's ability to use their intelligence to direct, change their way of thinking and actions when facing obstacles and difficulties. *Adversity quotient* helps individuals strengthen their ability and perseverance in facing the challenges of daily life while still adhering to principles and dreams regardless of what is happening (Stoltz, 2000; Nashori, 2007).

Adversity Quotient can be differentiated into climbers, campers, and quitters. Climbers are those who are always optimistic, see opportunities, see gaps, see a glimmer of hope behind despair, are always eager to move forward. Climbers are able to make small nudges that are considered trivial as a light that enlightens success (Hidayah, Mashuri, & Rahmawati, 2024). Campers are those who are satisfied with sufficiency and do not want to develop themselves. This type is a slightly more numerous group, namely the fulfillment of security needs and a sense of security (Stoltz, 2000) While quitters are those who choose to leave, avoid obligations, retreat and quit when facing difficulties.

Information about students' Adversity Quotient reflects the ability of the strategy they choose in dealing with problems students with Adversity Quotient certain groups will tend to survive until problems can be solved while students in other groups tend to avoid (Stoltz, 2000). Info about the student's Adversity Quotient is very important for teachers in determining learning strategies. The accuracy of choosing a learning strategy according to the student's circumstances will be able to force student achievement.

One way that can be done to achieve the goals of learning mathematics is to develop an educational program that focuses on developing thinking skills. The development of these abilities can be done through mathematics which can substantially encourage the development of students' thinking skills. Mathematical concepts are arranged in a hierarchical manner, structured, logical, and systematic ranging from the simplest to the most complex concepts, so they require good mathematical thinking skills to overcome them (Winarso, 2014)

RESEARCH METHODS

This study uses a descriptive type of research with a qualitative approach. This research was carried out from September 3 to October 04, 2024 which is located at MTsS Darul Hikmah Aceh Besar. In this study, the researcher gave an adversity response profile (ARP) questionnaire to 25 students in grade IX of MTSs Darul Hikmah. From these results, two subjects were obtained consisting of one climber and one camper subject. As for subjects with the category of quitters, they were not found. Furthermore, the two subjects were given problem solving test questions twice using flat-sided space building materials to measure students' thinking processes. The thinking indicators used in this study refer to the thinking indicators according to Zuhri (1998), which are as follows: 1) Conceptual thinking process, Students are able to express what is known in the problem in their own language or change it in mathematical sentences (B1.1), Students are able to express what is asked in the problem in their own language or change it in mathematical sentences (B1.2), Students are able to make plans complete completion (B1.3), Students are able to state the steps taken in solving the problem using concepts that have been learned (B1.4), and Students are able to re-check the truth or correct errors from each completion step so that the correct result is obtained (B1.5); 2) Semiconceptual thinking process, Students are less able to express what is known in the problem in their own language or change it in mathematical sentences (B2.1), Students are less able to express what is asked in the problem in their own language or change it in mathematical sentences (B2.2), Students are less able to make a complete solution plan (B2.3), Students are less able to state the steps taken in solving the problem using concepts that have been learned (B2.4), Students are less able to check the truth or correct errors from each step of completion so that mistakes often occur (B2.5); and 3) Semiconceptual thinking process, Students are unable to express what is known in the problem in their own language or change it in mathematical sentences (B3.1), Students are unable to express what is asked in the problem in their own language or change it in mathematical sentences (B3.2), Students are unable to make a complete solution plan (B3.3), Students are unable to state the steps taken in solving the problem using concepts that have been learned (B3. 4), The student is unable to check or re-correct the completed made (B3.5)

The data collection techniques are tests, and interviews. The test is in the form of problem-solving questions that contain criteria that measure students' thinking processes to obtain in-depth analysis of the criteria for the thinking process. The interviews conducted

are semi-structured, where the researcher will ask respondents according to the concept in the interview guidelines and questions can develop according to the data of the students' answer results. The data analysis techniques used in this study are Data Reduction, Data Presentation, and Conclusion Drawn. The validity of the data is checked using a time triangle.

RESULTS OF RESEARCH AND DISCUSSION

1. Students with the climbers category

Problems Given

The volume of a cube is equal to the volume of a block, which is 1,000 cm^3. It is known that the longest side length of a block is equal to twice the length of the cube ribs and the height of the block is equal to half the width of the block. Determine the area of the block!

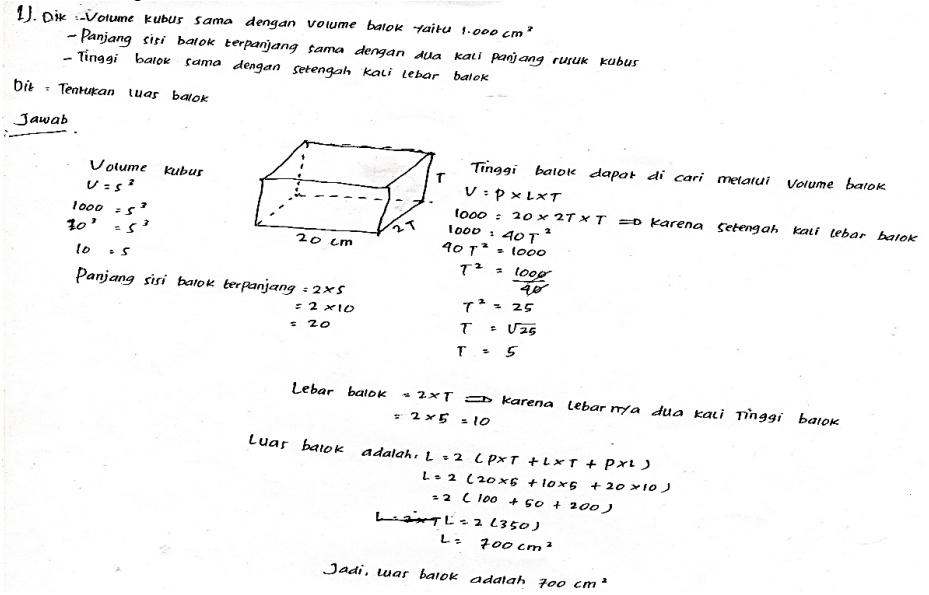

Figure 2
Climbers Students' Answers to the Problems Given

The climbers' student answers show that the student has stated the known information, what was asked in the question, and made a completion plan. The climbers' student answers also showed that the student had written down the completion steps. The student's ability to state the completion steps was also revealed during the interview. The following is an interview related to students' ability to state the steps to solve problems.

Researcher	: Based on the plan that has been prepared, how do you implement it?
Student	: First look for the length of the cube ribs of the pack.
Researcher	: How?
Siswa	: $V = s^3$, $1000 = s^3$, So the length of the rib cube or "s" is 10
Researcher	: Next?
Student	: Next looking for the longest length of the side of the block $p = 2 \times s, p = 2 \times 10, p = 20\ cm$

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Researcher : After getting the longest side length of the beam 20 cm, so on?
Student : Next, find the height of the beam using the known volume of the beam, the method is $V = p \times l \times t$
$1000 = 20 \times l \times t$, $1000 = 20 \times 2t \times t$, 1000
$40 \times t^2$, $t = \sqrt{\frac{1000}{40}} = \sqrt{25}$, so $t = 5\ cm$
Researcher : How wide is the beam?
Student : Beam width, , $l = 2 \times tl = 2 \times 5l = 10\ cm$
Researcher : After getting $p = 20$, $t = 5$ and the width $= 10$ then what?
Student : Next, I will look for the area of the block. The method is
$L = 2\ (20 \times 10 + 20 \times 5 + 10\ \times 5)$, $L = 2\ (350)$,
$L = 700\ cm^2$, so the area of the block is $700\ cm^2$

The climbers' student answers also show that the student has re-examined the completion steps. The following is an interview related to the student's ability to re-examine the steps to solve the problem.

Researcher : Are you sure of the final result?
Student : *(Thinking...)*. Sure, sir.
Researcher : Is it necessary or not to re-examine the truth of the answer?
Student : Yes, sir.
Researcher : If necessary, can you do an examination?
Students : Can you sir *(Review every step of completion that has been done and carry out re-examination).* This is right, sir.

In addition, the climber subjects can also solve problems that are equivalent to those given previously. Here are the problems:

The volume of a cube is equal to the volume of a block, which is 8000 cm^3.. It is known that the longest side length of a block is equal to twice the length of the cube ribs and the height of the block is equal to half the width of the block. Determine the area of the block!

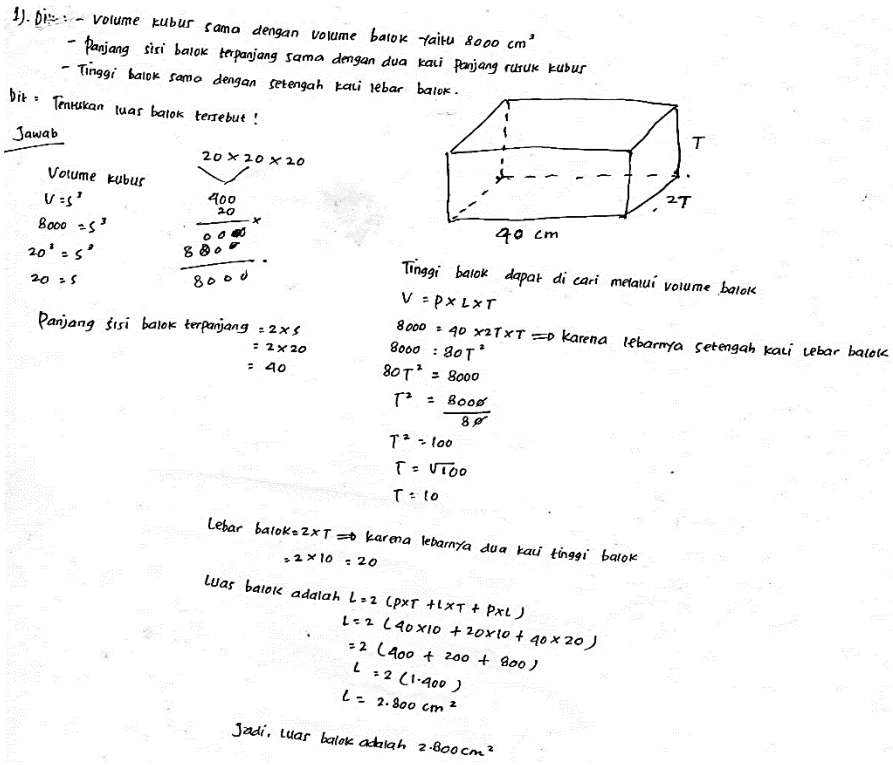

Figure 3
Climbers' Student Answers to Problems Equivalent to Problems Given

The climbers' student answers also show that the student has stated the known information, what was asked in the question, and made a completion plan. The climbers' student answers also showed that the student had written down the completion steps. The student's ability to state the completion steps was also revealed during the interview. The following is an interview related to students' ability to state the steps to solve problems.

Researcher	: Based on the plan that has been prepared, how do you implement it?
Student	: First look for the length of the cube ribs of the pack.
Researcher	: How?
Student	: $8000 = s^3$, then the value $s = 20$
Researcher	: Where to get 20?
Student	: $20 \times 20 \times 20$, Rib value of the cube
Researcher	: What's next?
Student	: Next look for the longest side length on the beam $p = 2 \times 20$, = 40 cm
Researcher	: The longest side length on the beam is already 40, so what else?
Student	: Next, find the height of the beam by using the volume of the beam, the way is, the width of the beam is changed, then $8000 = 40 \times 2t \times tl = 2t \;\; 8000 = 80 \times t^2$, $t = \sqrt{\frac{8000}{80}} = \sqrt{100}$, so $t = 10\ cm$

Researcher : How wide can it be?
Student : Beam width = $2 \times 1020\ cm$
Researcher : What else is looking for?
Student : Next, look for the area of the block. The method is
$L = 2\ (p \times l + p \times t + l \times t)$
$L = 2\ (40 \times 20 + 40 \times 10)$
$L = 2\ (1400)$, $L = 2800\ cm^2$
so the area of the block $= 2800\ cm^2$

The climbers' student answers also show that the student has re-examined the completion steps. The student's ability to re-examine was also revealed during the interview. The following is an interview related to the student's ability to re-examine the steps to solve the problem.

Researcher : Are you sure of the final result?
Student : *(Thinking.)*. Sure, sir.
Researcher : Is it necessary or not to re-examine the truth of the answer? That is necessary, sir.
Researcher : If necessary, can you do an examination?
Students : Can you sir *(Review every step of completion that has been done and carry out re-examination).* This is right, sir.

Table 1
Triangulation of Climber Students on the Problems Given

Problems Given	Equal Problems
Mention known correctly and fluently	Mention known correctly and fluently
Mention what is asked correctly and fluently	Mention what is asked correctly and fluently
Smoothly state the problem resolution plan that will be used to solve the problem	Smoothly state the problem resolution plan that will be used to solve the problem
• Carry out the completion plan that has been prepared in advance • Using the block volume formula • Finding the longest side length on the block • Finding the height of the beam • Finding the beam width • Finding the surface area of the beam	• Carry out the completion plan that has been prepared in advance • Using the block volume formula • Finding the longest side length on the block • Finding the height of the beam • Finding the beam width • Finding the surface area of the beam
Perform a smooth re-examination	Perform a smooth re-examination

The results of categorizing the thinking process of climber students in solving mathematical problems can be seen in the following table 2:

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Table 2
Categorization of Climbing Students' Thinking Processes in Mathematical Problem Solving

Thought Process	Indicator	Problems Given	Equal Problems
Conceptual	B1.1	√	√
	B1.2	√	√
	B1.3	√	√
	B1.4	√	√
	B1.5	√	√

Description: √ = Meet
× = Not Fulfilling

Based on the indicators that are fulfilled and guided by the classification of students' thinking processes, the climbing student thinking process is a conceptual thinking process, because the five indicators that are fulfilled in each problem lie in the same type of thinking process. This is in accordance with the results of research by Hidayah, Rahmah, & Lestari (2024) which states that subjects with climbers-type Adversity Quotient (AQ) tend to have a type of conceptual thinking process in solving problems

1. Students with the category of campers
Problems Given

The volume of a cube is equal to the volume of a block, which is 1,000 cm^3. It is known that the longest side length of a block is equal to twice the length of the cube ribs and the height of the block is equal to half the width of the block. Determine the area of the block!

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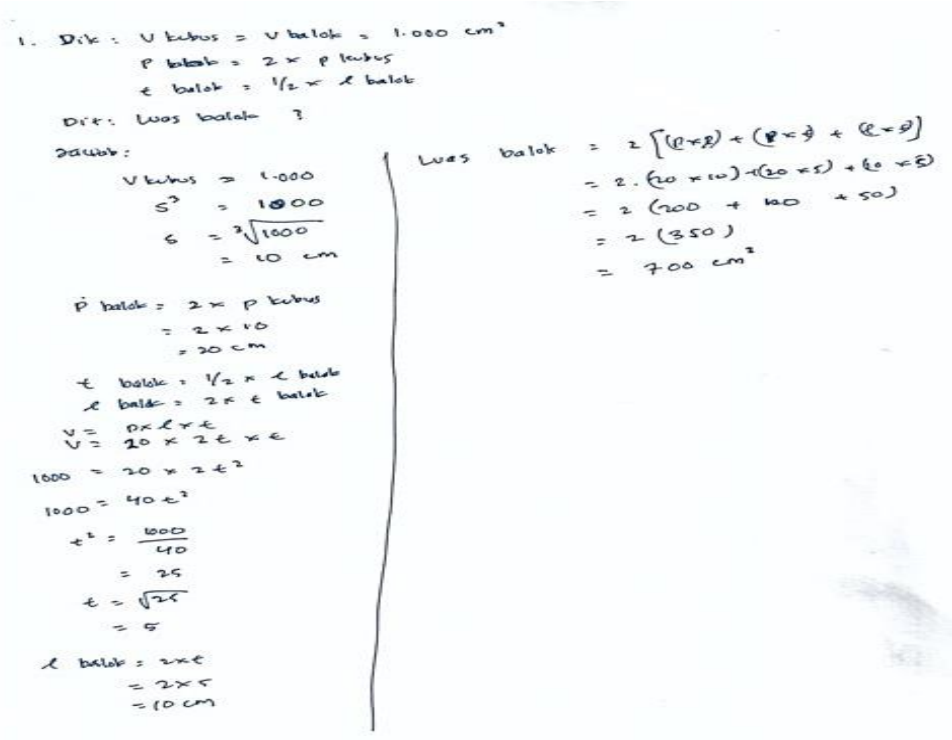

Figure 4
Campers Students' Answers to the Problems Given

The campers' student answers show that the student has stated the known information, what was asked in the question, and made a completion plan. The climbers' student answers also showed that the student had written down the completion steps. The student's ability to state the completion steps was also revealed during the interview. The following is an interview related to students' ability to state the steps to solve problems.

Researcher	: Based on the plan that has been prepared, how do you implement it?
Student	: First, I look for the length of the ribs of the cube.
Researcher	: How?
Students	: This is done using known volumes. $v = s^3$, 1000 = s^3, so s = 10
Researcher	: Next?
Student	: Next, looking for the longest side length of the block, the trick is $p = 2 \times$, cube ribs, $p = 2 \times 10$ obtained $p = 20$.
Researcher	: Next?
Student	: Next, I look for the height of the block. The method is $v = p \times l \times t$, 1000 = $20 \times 2t \times t$, 1000 = $20t^2$, so $t = \sqrt{\frac{1000}{40}}$, and then it was, $t = 5$. Then I continued to look for the width of the block.
Researcher	: How?

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Student : Beam width = 2 beam height, then, $\times l = 2 \times t$
$l = 2 \times 5$, obtained $l = 10$.
Researcher : Next, how do you find the area of the block?
Student : To find the area of the block, I used the formula
$L = 2(p \times l + p \times t + l \times t)$,
$L = 2(20 \times 10 + 20 \times 5 + 10 \times 5)$,
$L = 2(200 + 100 + 50)$,
$L = 2(350)$, then obtained
$L = 700\ cm^2$, so the area of the block is 700 cm^2

The campers' student answers also indicate that the student has re-examined the completion steps. The student's ability to re-examine was also revealed during the interview. The following is an interview related to the student's ability to re-examine the steps to solve the problem.

Researcher : Are you sure of the final result?
Student : *(Thinking).* Sure, sir.
Researcher : Is it necessary or not to re-examine the truth of the answer?
Student : Yes, sir.
Researcher : If necessary, can you do an examination?
Students : Can you sir *(Review every step of completion that has been done and carry out re-examination).* This is right, sir.

In addition, the campers can also solve problems equivalent to those given earlier. Here are the problems:

The volume of a cube is equal to the volume of a block, which is 8000 cm^3. It is known that the longest side length of a block is equal to twice the length of the cube ribs and the height of the block is equal to half the width of the block. Determine the area of the block!

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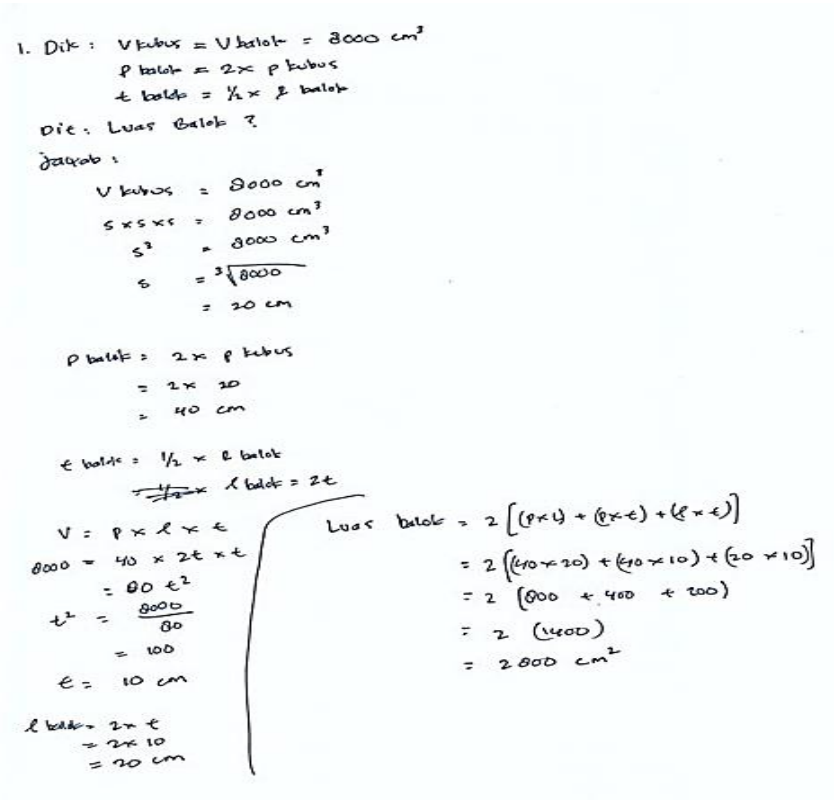

Figure 5
Campers Students' Answers to Problems Equivalent to Problems Given

The campers' student answers show that the student has stated the known information, what was asked in the question, and made a completion plan. The climbers' student answers also showed that the student had written down the completion steps. The student's ability to state the completion steps was also revealed during the interview. The following is an interview related to students' ability to state the steps to solve problems.

Researcher	: Based on the plan that has been prepared, how do you implement it?
Student	: First, I look for the length of the ribs of the cube. The trick is to use known volumes. $v = s^3$, 8000 = s^3, so s = 20
Researcher	: Next?
Student	: Next, look for the longest side length of the block, the method is $p = 2 \times$ cube ribs, $p = 2 \times 20$, obtained $p = 40$.
Researcher	: Then what else?
Student	: Then I look for the height of the beam. The method is $v = p \times l \times t$, 8000 = $40 \times 2t \times t$, 8000 = $80t^2$, so $t = \sqrt{\frac{8000}{80}}$, and then it was, $t = 10$. Then I continued to look for the width of the block.
Researcher	: How?

Student : Beam width = 2 × beam height, so $l = 2 \times t$,
$l = 2 \times 10$, obtained $l = 20$.
Researcher : Next, how do you find the area of the block?
Student : To find the area of the block, I used the formula
$L = 2(p \times l + p \times t + l \times t)$,
$L = 2(40 \times 20 + 40 \times 10 + 20 \times 10)$,
$L = 2(800 + 400 + 200)$,
$L = 2(1400)$, then obtained
$L = 2800\ cm^2$,

The campers' student answers also indicate that the student has re-examined the completion steps. The student's ability to re-examine was also revealed during the interview. The following is an interview related to the student's ability to re-examine the steps to solve the problem.

Researcher : Are you sure of the final result?
Student : *(Thinking...)*. Sure, sir.
Researcher : Is it necessary or not to re-examine the truth of the answer? That is necessary, sir.
Researcher : If necessary, can you do the examination?
Students : Can you sir *(Review every step of completion that has been done and carry out re-examination).* This answer is correct, sir.

Table 3
Triangulation of Camper Students on the Problems Given

Problems Given	Equal Problems
Mention the known correctly and lancer	Mention known correctly and fluently
Mention what is asked correctly and fluently	Mention what is asked correctly and fluently
Smoothly state the problem resolution plan that will be used to solve the problem	Smoothly state the problem resolution plan that will be used to solve the problem
• Carry out the completion plan that has been prepared in advance • Using the block volume formula • Finding the longest side length of the block • Finding the height of the beam • Finding the beam width • Finding the surface area of the beam	• Carry out the completion plan that has been prepared in advance • Using the block volume formula • Finding the longest side length of the block • Finding the height of the beam • Finding the beam width • Finding the surface area of the beam
Perform a smooth re-examination	Perform a smooth re-examination

Table 4
Categorization of Campers Students' Thinking Processes in Mathematical Problem Solving

Thought Process	Indicator	Problems Given	Equal Problems
Conceptual	B1.1	√	√
	B1.2	√	√
	B1.3	√	√
	B1.4	√	√
	B1.5	√	√

Description: √ = Meet
× = Not Fulfilling

Based on the indicators that are fulfilled and guided by the classification of students' thinking processes, the climbing student thinking process is a conceptual thinking process, because the five indicators that are fulfilled in each problem lie in the same type of thinking process. This is in accordance with the results of research by Hidayah, Rahmah, & Lestari (2024) which states that subjects with Adversity Quotient (AQ) of the campers type tend to have a type of conceptual thinking process in solving problems.

CONCLUSION

The thinking process of MTsS Darul Hikmah students based on the adversity quotient in the climber category has a conceptual thinking process. Likewise, students in the campers category also have a conceptual thinking process. This shows that these two categories, namely climbers and campers, have the same thinking process, namely the conceptual thinking process in solving mathematical problems in the building material of flat side spaces.

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