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Mathematical Reasoning Ability in Solving Flat Geometry Problems Based on Camper Type Adversity Quotient in Junior High School Students

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ABSTRACT

This research employed a descriptive qualitative approach to analyse the mathematical reasoning abilities of junior high school students when solving plane geometry problems, specifically focussing on their camper type adversity quotient. The research subjects consist of two students who were selected based on the Adversity Response Profile (ARP) questionnaire scores, namely two camper subjects with moderate scores. Furthermore, the researcher gave mathematical reasoning test questions on the quadrilateral material and conducted interviews with each subject. The researcher checked the validity of the data by using source triangulation. The analysis of mathematical reasoning ability is based on three indicators: finding mathematical patterns to make generalisations, performing mathematical manipulations, and drawing conclusions while compiling evidence and providing reasons for the correctness of the solution. The results of this research showed camper-type students used inductive reasoning, which is good in determining mathematical patterns, but cannot make appropriate generalisations of the patterns that were found. In doing mathematical manipulation, there are camper-type students who use trial and error strategies in solving geometry plane problems. Camper-type students can draw conclusions from a geometry plane problem but have difficulties in gathering evidence and providing reasons for the correct problem-solving.

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1. INTRODUCTION

Mathematics is one of the important materials in the world of education that has been taught from elementary school to college (Masingila & Olanoff, 2022). Nasrullah et al. (2021) said, "*This learning material and concept are hierarchical so that there are aspects of sustainability that affect the knowledge transfer process when students learn*." Mathematics learning materials and concepts are hierarchical so that there are aspects of sustainability that affect the knowledge transfer process when students learn. Talib

(2017) said that the objectives of mathematics learning in schools can be achieved well when teachers realise that teaching mathematics is not just about paying attention to the teaching strategies chosen but also about seeing and observing how students think, the process of developing students' knowledge through mathematical discussions, and finding ways for students to actively communicate the mathematical knowledge they have.

Pribadi et al. (2017) said that one of the international assessments that provides data on student achievement in relation to different curricula, teaching practices and school environments to measure and improve mathematics teaching and learning is TIMSS (Trends in International Mathematics and Science Study). Indonesia's achievement in TIMSS 2011, which was participated in by 42 countries, was that Indonesia's position was ranked 38th with a score of 386 points (Mullis et al., 2012). Indonesia's achievement in mathematics in TIMSS 2015 was still low, namely ranked 45th with a score of 397 points (Mullis et al., 2015). Indonesia's low achievement in TIMSS was caused by several factors. One of them is that the questions given to students in the international competition are different from the questions that can be given to most students in Indonesia. Based on the results of TIMSS 2015, it was found that Indonesia was still weak in the areas of geometric content and cognitive reasoning ability.

Lestari (2019) said that mathematical reasoning is very important in mathematics learning because it is a competency used as a basis for mathematical thinking. If students' mathematical reasoning develops, their ability to solve mathematical problems will also develop (Gultom & Saputro, 2022). This aligns with the objectives set by the Ministry of Education and Culture in 2013, which state that learning mathematics in junior high schools should include presenting, managing, and reasoning. One effort that can be made to improve students' mathematical reasoning abilities is by giving non-routine assignments (Muslimin & Sunardi, 2019).

The National Council of Teaching of Mathematics (NCTM) said that the mathematics subject that can train students' reasoning ability is geometry (Astiati, 2020). Annas et al. (2018) stated, "*Geometry is one of the branches of mathematics that discusses objects such as points, lines, surfaces, dimensions, and their connections; all of these objects are abstract*." Geometry is a science that discusses abstract objects, such as points, lines, surfaces, dimensions, and their relationships.

When the researcher conducted an interview with a mathematics teacher at Public Junior High School 4 Makassar, it was found that when students were faced with non-routine geometry problems, some of the students' learning outcomes were still low. One reason for this is that students in Indonesia still have a low level of mathematical reasoning ability. Students still require significant direct guidance to solve complex mathematical problems. Additionally, they often feel confused or struggle to identify what is known and what is being asked in these problems, which prevents them from solving mathematical issues effectively.

The difficulties experienced by students in solving math problems are caused by several intelligence factors, as well as students experiencing anxiety or fear in working on problems. A person's intelligence in facing difficulties or anxiety in facing problems is called adversity quotient (AQ) (Wahyuningtyas et al., 2020). Students who have high AQ will try their best to complete the math tasks given, both routine and non-routine problems. However, on the other hand, students with low AQ easily give up when faced with slightly difficult problems without trying first.

Mathematical Reasoning

The foundation of mathematics is reasoning. Reasoning is one of the basic competencies in mathematics besides understanding and solving problems (Lithner, 2017). The Ministry of National Education (Thalhah et al., 2013) asserted that one cannot separate mathematical material from reasoning. Material is understood through reasoning, while reasoning is understood and trained through learning mathematics. Salmina & Nisa (2018) said that mathematical reasoning ability is connecting problems into an idea or concept so that mathematical problems can be solved. Brodie (2009) stated that mathematical reasoning is reasoning about and with the object of mathematics. This statement can be interpreted that mathematical reasoning is reasoning about objects related to mathematics. In the Math Glossary, it is known that there are two things that students must have when doing mathematical reasoning, namely the ability to carry out mathematical problem-solving procedures and the ability to explain or provide reasons for the solutions made (Kusumawardani et al., 2018).

Fadilah (2019) said that in general mathematical reasoning is divided into two types, namely inductive reasoning and deductive reasoning. Inductive reasoning is a type of reasoning that starts from specific or single statements, then draws a general conclusion. Conversely, deductive reasoning can be understood as a type of reasoning that starts with general statements and then draws a specific conclusion (Molan, 2017). According to Sumarmo (Sari, 2019), indicators of deductive reasoning include (a) determining a trial-and-error strategy to solve problems, (b) solving problems by trial and error, (c) drawing general conclusions based on a number of observed data, and (d) drawing conclusions based on the similarity of data, concepts, or processes. The indicators of inductive reasoning include (a) work on particular cases (understanding the problem), (b) organisation of particular cases (processing data), (c) search and prediction of patterns (searching for and guessing patterns), (d) conjecture formulation (guessing formulas), (e) justification (validating conjectures based on data), and (f) generalisation.

Camper Type Adversity Quotient

Adversity quotient was first developed by Paul G. Stoltz. In short, Stoltz (2020) defines adversity quotient as the intelligence that a person has in facing difficulties and obstacles and being able to overcome them. Parvathy and Praseeda (2014) define "... *adversity quotient is the capacity to face and overcome the adversities* ...". Adversity quotient is the ability to face and overcome difficulties. So operationally, the adversity quotient is the persistence of students in facing and overcoming the difficulties of learning. In line with this opinion, Nurhayati & Fajrianti (2012) define adversity quotient as a person's ability to face problems that are considered difficult, but he will persist and try to solve them as well as possible to become an individual with good quality. Stoltz (2020) identified three types of adversity quotient character levels, namely climber (high AQ), camper (medium AQ), and quitter (low AQ). Furthermore, Stoltz (2020) suggested that there are four dimensions that will produce the adversity quotient (AQ). These dimensions will be used as a measuring tool to calculate AQ, which consists of dimensions C (Control), O_2 (Origin and Ownership), R (Reach), and E (Endurance).

This study will discuss the camper-type adversity quotient. Camper type AQ owners are those with AQ in the middle or medium position. Camper students are those who do not want to take too big a risk and are satisfied with the conditions or circumstances they have achieved at this time. Students who are classified as campers have a type of being easily satisfied or always feel that they are enough to be in the middle position.

Camper students in learning mathematics do not try their best, even though the opportunities and chances are there (Wardani & Mahmudi, 2019; Zubainur, 2020). They believe that simply graduating is sufficient for them; achieving higher honours or champion status is not a priority; instead, their main focus is on successfully completing their studies. Camper students in this study are students who do not want to take too big a risk and are satisfied with the conditions or circumstances that have been achieved in learning mathematics. Therefore, conducting a study on mathematical reasoning for solving flat geometry problems among junior high school students with camper-type AQ is important.

Plane Geometry

Geometry, according to Bird (2004), is a part of mathematics that discusses points, lines, planes, and space. Suyanto (2005) stated that geometry is an introduction to shape, area, volume, and area. A flat plane is usually described as the result of slicing a surface as thin as possible so that it has no thickness. A certain plane does not have a thickness measurement and only has a length and width measurement (Suharjana et al., 2009).

As'ari et al. (2017) found that flat shapes studied in junior high school are quadrilaterals and triangles. A quadrilateral is a plane polygon formed from four sides that intersect at one point. A triangle is a flat shape that is bound by three sides. The base of a triangle is one side of a triangle, while the height is a line perpendicular to the base side that passes through the vertex opposite the base side. TS & Wiyoto (2009) put forward the types of quadrilaterals, namely parallelograms, rectangles, rhombuses, squares, trapezoids, and kites. Meanwhile, the types of triangles can be reviewed based on the length of the sides and the size of the angles. Based on the length of the sides, there are arbitrary triangles, isosceles triangles, and equilateral triangles. Reviewed from the size of the angles, triangles are divided into three, namely acute triangles, obtuse triangles, and right triangles.

Based on the description of the problem, this study aims to describe the mathematical reasoning ability in solving flat geometry problems based on the camper-type adversity quotient in junior high school students.

2. METHOD

This study looks at how well junior high school students with a camper-type Adversity Quotient can solve flat geometry problems, focussing on their mathematical reasoning skills. The subjects of this study consisted of two students with camper-type AQ who had moderate scores. The tools used in this study included an AQ questionnaire called the Adversity Response Profile (ARP), a written test with 3 essay questions about quadrilaterals, and guidelines for interviews.

Data collection in this study began by giving the ARP questionnaire to grade VIII students at Public Junior High School 4 Makassar, then selecting two research subjects from AQ camper-type students. The adversity quotient category used in this study is based on the benchmark assessment from Stoltz (2020), as shown in Table 1 below.

Table 1. Adversity Quotient Categories

ARP Questionnaire Score	Category
0 – 59	Quitter (Low AQ)
60 – 94	Transition from quitter to camper
95 – 134	Camper (Medium AQ)
135 – 165	Transition from camper to climber
166 – 200	Climber (High AQ)

Following the subject selection process, we administered mathematical reasoning test questions to the selected AQ camper-type subjects and verified their answers through interviews. Furthermore, the results of the answers to the mathematical reasoning test interview were analyzed. The results of this analysis were presented in narrative form to describe the mathematical reasoning abilities of students with the AQ camper type.

3. RESULTS AND DISCUSSION

Description of Student Adversity Quotient (AQ) Types

The AQ type in class VIII at Public Junior High School 4 Makassar, totaling 102 students, was categorized based on the results of the ARP questionnaire. Based on the results of the ARP questionnaire scores of class VIII students at Public Junior High School 4 Makassar, 58 camper-type students were obtained, and 44 students with other types of AQ. Furthermore, we selected two camper subjects with moderate scores from the identified AQ types. In addition, the selected subjects can communicate well or express their opinions and ways of reasoning in writing or orally.

Description of Mathematical Reasoning Ability of AQ Camper Type Students

Ability to Find Mathematical Patterns to Generalize

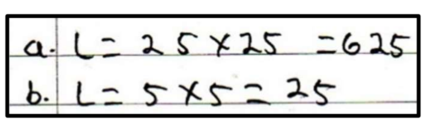

Figure 1. T1 Results of Subject C1

Interview Excerpts

PC1-T1-02 : *Try to explain in your own words what is meant by question number 1.*
SC1-T1-02 : *Square ABCD is the 1st unit that has a side length of 1 unit of length. This means that square ABCD has a side length of 1 unit of length, then square AEFG - square ABCD = side length of square AHIJ - side length of square AEFG = side length of square AKLM - side length of square AHIJ = 1 unit of length. This means that if the 4th square is subtracted from the 3rd square, the result is 1. So, it can be determined that ABCD is 1 unit of length, AEFG is 2 units of length, AHIJ is 3 units of length, and AKLM is 4 units of length.*
PC1-T1-03 : *Then how to determine the area of the 25th square?*
SC1-T1-03 : *The area of the 25th square, using the area formula, namely s x s = 25 x 25 x = 625.*
PC1-T1-04 : *So, to determine the nth square, how? Or which square is the nth square?*
SC1-T1-04 : *Maybe it means the next square. If this is only 4 squares, maybe it means the 5th square. Just enter the area formula. 5 x 5 = 25.*

The written test results showed that C1 was able to answer mathematical reasoning questions on question number 1 by writing the correct answer. However, the mathematical pattern written by C1 was not yet visible. However, the results of the C1 interview related to student knowledge of problem T1, subject C1, were able to explain the solution to question number 1. C1 explained how to be able to determine the mathematical pattern (SC1-ST1-02). The patterns found were square ABCD, or the first square with a side length of 1 unit; square AEFG, or the second square with a side length of 2 units; square AHIJ, or the third square with a side length of 3 units; and square AKLM, or the fourth square with a side length of 4 units. However, C1 was unable to generalize correctly, namely being unable to determine the area of the nth square correctly (SC1-T1-04). The results concluded that C1 in the mathematical reasoning ability indicator met the category of finding mathematical patterns but was unable to make a generalization.

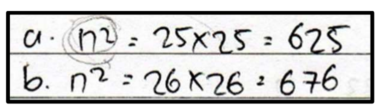

Figure 2. T1 Results of Subject C2

PC2-T1-02 : *Please explain in your own words what is the meaning of question number 1?*
SC2-T1-02 : *The difference between all squares is 1 unit of length. ABCD is 1, AEFG is 2, AHIJ is 3, AKLM is 4.*
PC2-T1-03 : *How do you find the area of the 25th square, why is the answer n = 25.*
SC2-T1-03 : *Because it uses a number pattern*
PC2-T1-04 : *Why?*
SC2-T1-04 : *The formula is n2, so I multiply 25 x 25 because the question is the 25th pergei.*
PC2-T1-07 : *Then part b, why did you say that the area of the nth square is the area of the 26th square?*
SC2-T1-07 : *Because what crossed my mind, sis, n is the next square from the 25th square.*

The written test results showed that C2 was able to answer mathematical reasoning questions on question number 1 part a by writing the correct answer, but the answer on question number 1 part b was not correct. In addition, the mathematical pattern written by C2 was not yet visible. However, the results of the C2 interview related to student knowledge of problem T1; subject C2 was able to explain the solution to question number 1. C2 explained how to determine the mathematical pattern (SC2-T1-02). The patterns found were square ABCD with a side length of 1-unit, square AEFG with a side length of 2 units, square AHIJ with a side length of 3 units, and square AKLM with a side length of 4 units. Further investigation revealed that C2 identified a pattern by connecting the concept of number patterns (SC2-T1-03). However, C1 was unable to make a correct generalization because they could not determine the area of the nth square accurately (SC2-T1-07). The results concluded that C2 on the mathematical reasoning ability indicator meets the category of finding mathematical patterns but cannot make a generalization.

Based on the two explanations above, the research subjects on the indicator of finding mathematical patterns to generalize tend to be consistent. Therefore, the camper-type AQ subjects' data can determine square side length patterns, but they can't generalize the nth square's side length and area.

Ability to Perform Mathematical Manipulation

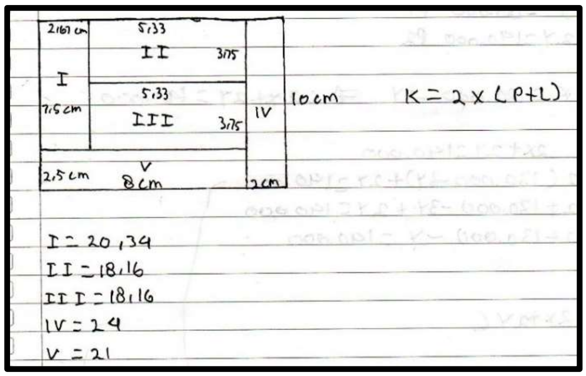

Figure 3. T2 Results of Subject C1

Interview Excerpts

PC1-T2-03	:	*How to find the perimeter of this rectangle, what are the steps you provide?*
SC1-T2-03	:	*First, find the area of KLMN square. So, 10 x 10 = 100. Then divide it into 5 rectangles. So, 100:5=20*
PC1-T2-05	:	*Then how to find the perimeter of each?*
SC1-T2-05	:	*L to M should be 10 cm, just find the width. The formula for finding the width is L: p=20:10 = 2. This means that the length of the 4th rectangle is 10, while the width is 2. Use the perimeter formula, which is 2 (p + l) the result is 24 cm.*
PC1-T2-06	:	*Then after that, which rectangle is the other?*
SC1-T2-06	:	*5th.*
PC1-T2-07	:	*Why?*
SC1-T2-07	:	*K to L is 10 cm, but it is cut with the width of L to M which is 2 cm. So, 10-2 cm = 8 cm. …. So, 20:8 = 2.5. So, the width is 2.5. The circumference is 2 (p + l) = 21 cm. and so on.*
PC1-T2-08	:	*and so on, right? So, if it's already the 5th square, which rectangle is next?*
SC1-T2-08	:	*1st.*
PC1-T2-09	:	*After rectangle 1?*
SC1-T2-09	:	*2nd*
PC1-T2-10	:	*Then?*
SC1-T2-10	:	*Third*
PC1-T2-11	:	*Why do the second and third rectangles have the same circumference?*
SC1-T2-11	:	*Because it is cut with the width of L to M. It is the same width and length.*

The written test results showed that C1 was able to write the answer to the mathematical reasoning question number 2 correctly. However, C1 did not write down the strategies used in carrying out mathematical manipulation. But according to the interview results, C1 was able to provide an explanation of how to properly answer the mathematical reasoning question. C1 explained the facts contained in the question, namely the size of the square KLMN and the 5 rectangles in it that have the same area (SC1-T2-03 and SC1-T2-07). Therefore, C1 found a principle by linking the concept of the area of a square with the concept of the area and perimeter of a rectangle (SC1-T2-05). C1 determined the area of the square KLMN, then determined the perimeter of each rectangle in sequence, namely rectangle IV, rectangle V, rectangle I, rectangle II, and finally rectangle III (SC1-T2-05, SC1-T2-06, SC1-T2-08, SC1-T2-09, SC1-T2-10). These calculations allowed subject C1 to correctly determine the perimeter of each of the five rectangles.

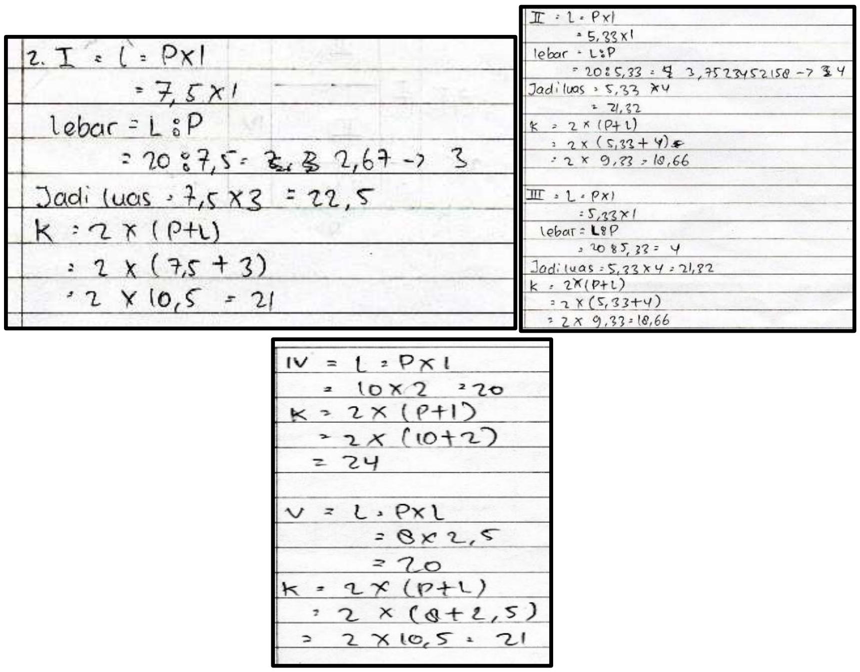

Figure 4. T2 Results of Subject C2

Interview Excerpts

PC2-T2-03 : What is the area of the KLMN rectangle?
SC2-T2-03 : 100 cm, then divided into 5.
PC2-T2-06 : Then after you know the area of each rectangle is 20, what do you do next?
SC2-T2-06 : Find the perimeter
PC2-T2-07 : Which rectangle should be the perimeter first?
SC2-T2-07 : The 4th rectangle
PC2-T2-09 : How do you do it?
SC2-T2-09 : First find the area, p x l = 10 x 2 = 20
PC2-T2-10 : Why is the width 2?
SC2-T2-10 : Because 20:10 = 2, so 10 x 2 = 20. Then find the perimeter. 2 (p + l) = 2 (10 + 2) = 24
PC2-T2-09 : After knowing 24, which rectangle is next?
SC2-T2-11 : The 5th
PC2-T2-12 : Why?
SC2-T2-12 : Because KL is already known to be 10 wide, the intersection here is clearly 2. So, 10 – 2 = 8. So, the length of the 5th rectangle is 8 then 20:8 = 2.5. So, the area is 8×2.5 = 20. The perimeter is 2 (p + l) = 2 (8 + 2.5) = 21
PC2-T2-13 : after the 5th rectangle, how many more rectangles are there?
SC2-T2-13 : 1st.
PC2-T2-14 : The reason why?
SC2-T2-14 : because the length of KM is clearly 10, then the intersection is 2.5 so just subtract it. .... So, the area is p x l = 7.5 x 1 = 7.5
PC2-T2-15 : What about the width?
SC2-T2-15 : Oh, the width is not yet known.
PC2-T2-16 : so how to find out the width?

SC2-T2-16	:	*Area: length. The area is 20, the length is 7.5 so it is divided. The result is 3 after being rounded. So, the area is 7.5 x 3=22.5*
PC2-T2-18	:	*...it was said earlier that each rectangle has the same area, why is there another area of 22.5?*
SC2-T2-18	:	*because there is an intersection*
PC2-T2-19	:	*So, do not all the rectangles here necessarily have the same area?*
SC2-T2-19	:	*Yes*
PC2-T2-21	:	*Then what else is being looked for?*
SC2-T2-21	:	*second and third perimeter*
PC2-T2-24	:	*then the perimeter of the second rectangle is the same as the perimeter of the third rectangle?*
SC2-T2-24	:	*it is the same because the intersection is the same*
PC2-T2-25	:	*So, did you use a trial-and-error system to determine this? (perimeter of the rectangle)*
SC2-T2-25	:	*Yes, it was like that at first.*

The written test results showed that C2 was able to write the answer to the mathematical reasoning question number 2 correctly, but there was an error in the strategy used in carrying out mathematical manipulation. In the interview results, C2 explained the facts contained in the question, namely, the size of the KLMN square is 100 cm², which is divided into 5 rectangles. On the T2 answer sheet, C2 wrote that the five rectangles have different areas. After being traced through interviews, it was found that C2 used a trial-and-error system to determine the perimeter of the rectangle.

However, C2 found a principle by linking the concept of the area of a square with the concept of the area and perimeter of a rectangle. C2 determined the area of the KLMN square and then determined the perimeter of each rectangle in sequence, namely rectangle IV, rectangle V, rectangle I, rectangle II, and finally rectangle III. This allowed subject C2 to correctly determine the perimeter of each of the five rectangles.

Based on the two explanations above, the research subjects on the mathematical manipulation indicator tend to be consistent. Thus, it can be concluded that the data from the camper-type AQ subjects can carry out mathematical manipulation well.

Ability to draw conclusions, compile evidence, and provide reasons/evidence for the truth of solutions

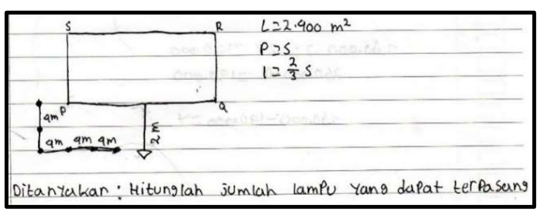

Figure 5. T3 Results of Subject C1

Interview Excerpts

PC1-T3-02	:	*Try reading it again in your own words, what does question number 3 mean?*
SC1-T3-02	:	*There is a rectangular PQRS park with an area of 2,400 m2. The park has a length = s, and a width = 2/3 of the length of the park or 2/3 s. around the park, lights will be installed from the outside of the park with 2 m. So, later outside of the park, lights will be installed at a distance of 2m. If the distance between lights is 4 m, it means the distance between each light is 4 m. So light 1 to light 2, light 2 to light 3, the distance will be 4 m.*
PC1-T3-03	:	*My question is, do you draw a picture 2 m from the middle of PQ between P and Q. Why not, for example, at the corner of P you draw 2 m, or is 2 m here at the corner of P the same as 2 m?*
SC1-T3-03	:	*Different*
PC1-T3-05	:	*My next question is, here the lights that will be installed are 4 m apart, what shape will this row of lights look like?*
SC1-T3-05	:	*Rectangular.*
PC1-T3-06	:	*To determine the number of lights to be installed, do you know what strategy is used?*

SC1-T3-06 : *No*

Based on the results of the written test of mathematical reasoning ability on question number 3, it shows that C1 cannot solve the mathematical reasoning problem on question number 3. Then, the results of the interview with subject C1 show that C1 can draw the conclusion that the lights that will be installed around the outside of the park will form a rectangle (SC1-T3-05). However, C1 cannot explain further about compiling evidence and cannot provide a solution to the problem (SC1-T3-06).

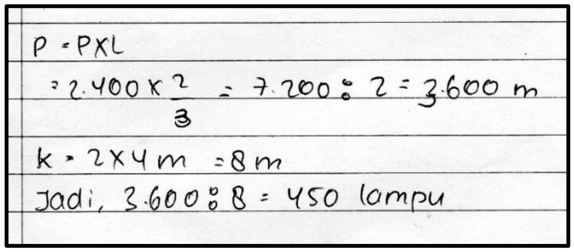
P = P X L
= 2.400 X 2/3 = 7.200 : 2 = 3.600 m
k = 2 X 4 m = 8 m
Jadi, 3.600 : 8 = 450 lampu

Figure 6. T3 Results Subject C2

Interview Excerpt

PC2-T3-02	:	Try reading it again in your own words, what is the purpose of question number 3?
SC2-T3-02	:	So, determine how many lights will be installed in the PQRS park with an area of 2,400 m2
PC2-T3-03	:	Then what about the length and width?
SC2-T3-03	:	Up to that point I understand, sis. I don't know the rest.
PC2-T3-04	:	Try explaining what you wrote, why is the answer like that?
SC2-T3-04	:	This is length = p x l (showing the answer sheet). This is length = s, this is what I put in.
PC2-T3-05	:	Why?
SC2-T3-05	:	Because I didn't get this (shown in the question p = s) so I tried to put this in multiplied by the width by 2/3.
PC2-T3-06	:	What do you think is 3,600 meters?
SC2-T3-06	:	The length of the rectangle

Based on the results of the written test of mathematical reasoning ability on question number 3, it shows that C2 cannot solve the mathematical reasoning problem on question number 3. Then, the results of the interview with subject C2 show that C2 can draw the conclusion that the lights that will be installed around the outside of the park will form a rectangle (SC2-T3-06). However, C2's evidence and solutions provided to solve it are not yet correct (SC2-T3-04 and SC2-T3-06).

Based on the two explanations above, the research subjects tend to be consistent in drawing conclusions, compiling evidence, and providing reasons for the truth of the solution. The camper subject concluded that the lights that will be installed will form a rectangle but could not compile evidence and provide reasons for the problem.

Discussion

Based on the analysis of the results of the test and interviews of students' mathematical reasoning abilities, it was concluded that in solving problems on the indicator of finding mathematical patterns to generalize, students with camper-type AQ use inductive reasoning. Camper students can understand problems, process data, and find and predict patterns. This capability is shown by the way camper students determine the pattern of the length of the side and the area of the 25th square correctly by linking it to the concept of number patterns. However, camper students cannot predict the formula for the area of the nth square using the pattern they have found, so camper students cannot generalize the formula for the area of the nth square.

In line with the results of research conducted by Saputri et al. (2017) that students cannot find patterns to generalize, this is because students still do not understand the meaning of the variable n, so they are unable to solve the problems given. Research conducted by Sari et al. (2016) found that some students make mistakes in finding the next term of a number pattern, leading them to write the next pattern by guessing. Thompson et al. (2012), in his research, stated that when students can use patterns to determine the next term, then they have good mathematical reasoning skills.

Analysis of the results of the test and interviews of students' mathematical reasoning skills in solving problems on the indicator of performing mathematical manipulation concluded that students with AQ-type campers understand the questions given by showing the facts contained in the questions. Camper students use a solution strategy by linking the concept of the area of a square with the concept of the area and circumference of a rectangle. However, there are camper students who use reasoning with a trial-and-error strategy.

This study is in line with the results of the study by Ardhiyanti et al. (2019) that students with moderate mathematical abilities can manipulate to solve the problems given well. The results of this study are in line with Hidayah et al. (2018), who revealed that manipulating written or oral questions in geometry learning improves students' conceptual understanding abilities in geometry learning. By completing the mathematical manipulation indicator questions given, students can further explore their knowledge by linking one concept to another, namely the concept of the area of a square with the area and circumference of a rectangle.

Based on the analysis of the test results and interviews of students' mathematical reasoning abilities in solving problems on the indicators of drawing conclusions, compiling evidence, and providing reasons or evidence for the correctness of the solution, it was concluded that students with camper-type AQ can conclude that the lights to be installed will form a rectangle. Camper students understand the geometry problems given; this was explained during the interview. However, camper students can provide an assumption that the lights to be installed will form a rectangle but cannot provide a logical reason. Camper students cannot compile evidence or determine the correct mathematical solution because camper students have difficulty changing story problems into mathematical models. Therefore, camper students cannot conclude how many lights will be installed.

The results of the study above are in line with the research of Asdarina & Ridha (2020), which states that students solve problems where students do not provide clear and precise reasons. Students do not use the correct steps in the problem-solving process; learners only conclude answers that are considered correct without proving them first. In addition, students have difficulty identifying problems in questions in the form of story problems. According to Winarti & Murtiyasa (2016), their research indicates that difficulty in identifying problems hinders students' ability to determine the mathematical methods needed to solve those problems. These effects can be seen from students having difficulty in connecting real situations with mathematics, in determining the relationship between each known relationship in the question, and in incorrect calculations.

According to Stoltz (2020), the dimensions that contribute to a person's adversity quotient, known as CO2RE (control, origin and ownership, reach, and endurance), indicate that when a student has higher control, they are more likely to believe that the difficulties in solving mathematical reasoning questions can be managed; conversely, when a student has lower control, they tend to believe that these difficulties cannot be managed. In the dimensions of origin and ownership, the higher a student's AQ, the more they consider success to always exist and the cause of difficulties to come from outside, and vice versa: the lower a student's AQ, the more they consider success to not always exist and the cause of difficulties to come from themselves. In the reach dimension, the higher the AQ of a student, the more able he/she is to limit the scope of his/her problems in working on mathematical reasoning problems, and conversely, the lower the AQ of a student, the less able he/she is to limit the scope of his/her problems in working on mathematical reasoning problems. In the endurance dimension, the higher the AQ of a student, the more able he/she is to face various difficulties in working on mathematical reasoning problems and views that success will last a long time or even permanently so that it is necessary to re-check the answers obtained. Likewise, the lower the endurance dimension, the lower the AQ of a person, and the greater the difficulty a student always faces in working on mathematical reasoning problems and views that success will not last long, so that it is not necessary to re-check the answers obtained.

Therefore, the success of students' mathematics learning does not always depend on their cognitive aspects alone. Other influential aspects include the adversity quotient, which helps foster a strong sense of perseverance in students. The sense of never giving up will play a role in giving rise to the urge to continue trying everything to produce students who are persistent and never give up in solving mathematics problems. By fostering an adversity quotient in students, they will not easily give up when faced with difficulties and will become intelligent individuals in determining the right strategies to solve the mathematics problems they face.

4. CONCLUSION

AQ camper-type students can use inductive reasoning well and can determine mathematical patterns but cannot make accurate generalizations from patterns that have been found. In carrying out mathematical manipulation, there are camper students who use a trial-and-error strategy. In addition, camper students can draw conclusions from a flat geometry problem but have difficulty compiling evidence and providing reasons for the correctness of the solution.

For further research, it is hoped that to re-examine mathematical reasoning abilities more completely, verification needs to be carried out by (a) developing other geometry materials such as flat/curved-sided solids, circles, etc.; (b) indicators of mathematical reasoning abilities entirely, with various ways of thinking of research subjects; and (c) allocating more time and a wider research location so that the results obtained are deeper and more comprehensive.

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