Students Competence in Solving Hots Math Problems Studied from Adversity Quotient

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ABSTRACT

Solving HOTS math problems requires high-level thinking skills that also require students to have high-level adversity quotient in order to solve HOTS-type problems. This research aims to study and describe the competence level of elementary school students in solving HOTS math problems and to identify how students from various types of adversity quotient competences solve HOTS math problems. This research is a descriptive qualitative one using case study method. The research population was one of elementary schools in South Jakarta area, while the research sample was 110 fifth-grade students. The research sample was determined using non-probability sampling. Instruments used were essay tests, adversity quotient questionnaires, and interview guidelines. The research shows a result that on the average, elementary school students are categorized as camper-type of adversity quotient in which camper-type students are able to understand problems but have not yet able to plan a strategy for solving it, while quieter-type students are not able to meet all indicators in HOTS problem solving.
Keywords: Problem Solving Competence, High Order Thinking Skill (HOTS), Adversity Quotient.

INTRODUCTION

In the era of industrial revolution 4.0, math learning prioritizes on work and problem solving skills (Hadi & Zaidah, 2020). In addition to these two skills, in 2013 curriculum, math competencies included critical thinking, creativity, communication, and collaboration. Math competency is needed to enable students to face, process, and use information to deal with problems in everyday life. Regulation of Minister of National Education (Permendiknas) No. 22 of 2006 concerning Content Standards (Kemendikbud, 2016) in item five provides an explanation that strengthen the psychological aspects of math learning, which a goal that students appreciate the benefit of math in life, namely: curiosity, attention, interest in learning math, tenacity and confidence in problem solving. Of those aspects, the psychological aspect includes a person's intelligence in dealing with problems known as the adversity quotient (Hidayat & Sariningsih, 2018). According to (Daryanto, 2013), math is the basic for the science development which is very useful for life. Therefore math is included in education from kindergarten to college. Math is very important and must be mastered by students, and this is a challenge for teachers in achieving the goals of mathematical competence. Teachers, in addition to providing teaching materials that attract students' attention in math learning, must also provide high order thinking skills (HOTS) questions in order to train and familiarize students to solve problems by thinking critically, creatively, and innovatively.

Giving HOTS math questions also shows how students' efforts and competence when they find difficulties in the questions. However, in real life, students are still difficult to solve problems requiring high order thinking skills, it does not just happen without any reason behind it, there are several matters that make student weak in solving HOTS-type math problems, it is strengthened by the statement of (Lewy et al., 2013) that math learning is currently focused on procedural skills, monotonous class atmosphere, one-way communication, low-order thinking skill tendency, and relying on textbooks only.

Higher Order Thinking Skills (HOTS) is a type of learning that requires higher cognitive processing and has more general benefits than Lower Order Thinking Skills (LOTS). Meanwhile, (Hidayat & Sariningsih, 2018) describe that high-order thinking-type questions, including open-ended questions, have many ways to solve problems, thus, students' answers will vary according to the students' learning experience, abilities, and level of creativity. Students who are able to solve high-order thinking skills-required questions well must have the ability to solve problems competently. One's ability to deal with challenges or problems and to find out solutions to a problem is known as adversity quotient (AQ) (Suhandoyo & Wijayanti, 2016). (Stoltz, 2000)argues that it not only IQ and EQ but also adversity quotient that have huge big impact on determining students' success in learning. Adversity quotient affects students' math learning performance, because, in math learning, it enables students to deal with mathematical problems that are closely related to daily life. (Stoltz, 2000) divide adversity quotient into 3 types, namely: quitter (low), camper (medium), and climber (high). Quitter-type students are those who easily give up in solving problems, especially solving HOTS math questions that require high-level

thinking; quitter-type students will not solve difficult problems completely. Camper-type students tend to be quickly satisfied with what they have achieved, this type of students are reluctant to try harder to achieve maximum results, they just solve problems without caring about the correct problem solving, they have no effort to study harder, and to be champions. While climber-type students have much efforts and intention to study harder and they hardly give up in solving problems; climber students have goals and always try their best.

Adversity Quotient reflects how students solve problems, particularly in solving HOTS-type math problems. Students with high adversity quotient must be able to solve HOTS problems well even though there are difficulties, they will be motivated to solve them. On the other hand, students with low adversity quotient will find it difficult, confused, and reluctant to solve the problems that can lead to hatred to math. The previous research conducted by (Hadi, 2019) shows that on average, in relation to solving HOTS-type questions, students are categorized as campers-type and there is no correlation between students' competence level in solving math problems and adversity quotient. Meanwhile, a research conducted by (Nurlaelah et al., 2015) shows that students' adversity quotient is categorized as campers-type and adversity quotient has influence to the ability of elementary school students in solving math problems.

Referring to the research conducted by (Haniffah & Manoy, 2018) and statement from fifth grade teachers at one of elementary schools in South Jakarta area, it is still difficult for elementary students to understand and solve HOTS-type math problems well. Low adversity quotient in solving HOTS-type problems was seen when the teacher gave explanation; students rarely asked although they often fail to answer questions when teacher gave HOTS-type math problems, they tend to answer HOTS questions using one way only or answer the question as the example given by their teacher without any effort to find alternative answers in different ways. According to (Hasan, 2016), students' competence in solving HOTS math problems can be influenced by many factors such as strong will and fight power in solving problems exist in the question, it requires high level of ability and hard work. Such fight power and hard work is called student's adversity quotient.

This research aims to study and describe the competence level of elementary school students in solving HOTS math problems in terms of the student's adversity quotient and to identify the abilities of students of quitters-, campers-, and climbers-types in the process of solving HOTS math problems/questions.

METHOD

This research is a descriptive qualitative. This research involved 110 fifth-grade students with non-probability sampling technique. The research was conducted in one of public elementary schools in South Jakarta. Data was collected using tests, questionnaires, and interviews. The tests were to measure students' competence in solving HOTS math problems/questions, questionnaires was to determine students' adversity quotient, and interviews was to confirm answers and data collected from the students' competence. The questionnaire used in this study referred to article wrote by (Alyani & Zahra, 2020) that studies and analysis students' adversity quotient in math. Answers in the questionnaire used likert scale consisting of five choices, namely, "strongly

disagree, disagree, neutral, agree, strongly agree" (Alyani & Zahra, 2020). Adversity quotient indicator is presented in the following table:(Afri, 2018).

Table 1. Adversity Quotient Indicator

Kategori AQ	Indikator
Quitter	1. Tend to stay away from problems. 2. Efforts to solve the problem are very minimal.
Camper	1. There is an attempt to solve the problem. 2. Feeling satisfied with the effort made even though it is not on target.
Climber	1. Tenacious in solving problems. 2. Endeavor until the goal or target is reached.

Problem-solving competence test for HOTS math question was in the form of essay questions with a subject of structure volume consisting of 5 questions. The test instrument referred to the indicators of polya problem solving steps presented in the following table: (Puspa et al., 2019).

Table 2. Indicators Of Polya Problem Solving Steps

Problem Solving Stages	Indicator
Understanding the problem	Students are able to identify information that is known and which is asked in the question.
Planning a problem-solving strategy	Students are able to relate the information obtained from questions and develop strategies for solving them.
Implementing a problem solving strategy	Students are able to carry out problem-solving plans with strategies that have

	been prepared appropriately.
Truth check	Students re-examine the answers correctly and are able to write conclusions.

The validity and reliability of questionnaire instruments was measured by the Rasch model using Winsteps version 4.4.2 software. Rasch Model can improve and evaluate research instruments (Rahayu & Alyani, 2020). The criteria for validity test used Rasch model namely, the outfit mean square value accepted ($0.5 <$ outfit – mean square < 1.5), outfit z-standard value accepted ($-2.0 <$z-standard $< +2.0$), and point measure correlation value accepted ($0.4 <$point measure corr< 0.85) (Sumintono & Widhiarso, 2015). Then, item reliability and person reliability values were determined using the following criteria: (Sumintono & Widhiarso, 2015).

Table 3. Rasch Model Reliability Criteria

Reliability Value (Item/Person)	Interpretation
$> 0,94$	Special
$0,91 – 0,94$	Very Good
$0,81 – 0,90$	Good
$0,67 – 0,80$	Sufficient
$< 0,67$	Weak

Subsequently, interviews were conducted to 3 selected students. These students were selected from logit value that represented each student's competence level (high, medium, low) in solving HOTS math questions based on wright map results generated by winsteps application calculation.

RESULTS AND DISCUSSIONS

Instrument

The validity test results from adversity quotient questionnaires obtained 29 invalid items and 57 invalid respondents. The instrument of HOTS math problem-solving competence test found that 1 item was invalid and 74 respondents were invalid.

The reliability test using adversity quotient questionnaires, found that item reliability was 0.92; personal reliability was 0.75; and *Cronbach's Alpha* was 0.75. It can be concluded that the quality of adversity quotient questionnaire items was very good, while students' competence, in responding the questionnaire statements and interaction between items and persons, was categorized as sufficient (Sumintono & Widhiarso, 2015).

Table 4. Summary Statistics Questionnaire

	Mean	SD	Reliability	Cronbach
Person	0,04	0,27	0,75	0,75
Item	0,08	0,40	0,92	

In addition, the results of reliability test of problem-solving competence test instrument for HOTS math questions obtained item reliability of 0.91; personal reliability of 0.95; and *Cronbach's Alpha* of 0.90. It can be concluded that the quality of test items was categorized as very good, while students, in answering questions on the test items were categorized as special, and the interaction between items and persons was categorized as good (Sumintono & Widhiarso, 2015).

Table 5. Summary Statistics Test Questions

	Mean	SD	Reliability	Cronbach
Person	0,32	1,84	0,95	0,90
Item	0,21	0,35	0,91	

Adversity Quotient

Figure 1. is a wright map from Winsteps application to analyze the adversity quotient questionnaires. It can be seen that the logit value from 2 to -1 on the left side is a person map that describes the students' competence level, while the right side is an item map that describes the difficulty level of the item. Student 044 was at the bottom which means that student number 044 has low competence level and based on wright map, there is no student on the top, meaning that there was no student with the highest competence. In addition, item number I26 is on the top which means that the item is categorized as high difficulty level and item number I41 was at the very bottom which means that the item has the lowest difficulty level.
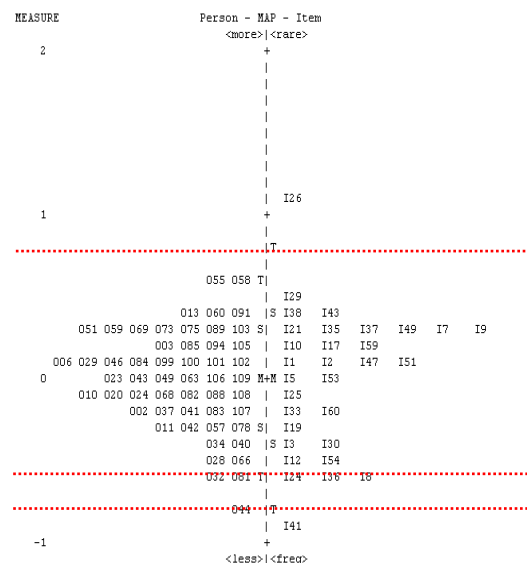

Figure 1. Wright Map Adversity Quotient Questionnaire

In Figure 2. there is a measure, namely logit data from each item that shows difficult and easy questions (item fit), there is also a total count to find out the amount of missing data and 53 students could answer the statements in adversity quotient questionnaires. In the item column, it shows that item number

I26 is on the top which means that item I26 is the most difficult to do, while item I41 is at the bottom which means that the item has low difficulty level. Meanwhile, *Outfit MNSQ, ZSTD,* and *PT-MEASURE CORR* columns were used by researchers to identify whether the data was valid or not based on Rasch Model criteria.

Item STATISTICS: MEASURE ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD	PTMEASUR-AL CORR.	EXP.	EXACT OBS%	MATCH EXP%	Item
15	89	53	1.06	.15	1.14	.61	.94	-.15	.38	.25	32.1	40.4	I26
16	122	53	.49	.12	1.13	.83	1.10	.61	.34	.33	35.8	27.5	I29
22	130	53	.39	.11	1.03	.26	1.03	.27	.43	.34	22.6	25.4	I38
24	130	53	.39	.11	.77	-1.57	.78	-1.44	.42	.34	34.0	25.4	I43
26	133	53	.35	.11	1.15	1.00	1.13	.86	.37	.34	18.9	25.3	I49
12	135	53	.32	.11	.86	-.92	.85	-.96	.38	.35	22.6	25.3	I21
7	136	53	.31	.11	.98	-.08	.97	-.14	.45	.35	20.8	24.9	I9
5	139	53	.27	.11	.96	-.20	.92	-.50	.48	.35	30.2	24.7	I7
21	139	53	.27	.11	.89	-.73	.88	-.78	.23	.35	28.3	24.7	I37
19	140	53	.26	.11	1.28	1.82	1.27	1.67	.11	.35	18.9	24.6	I35
8	142	53	.23	.11	1.03	.24	1.02	.21	.36	.35	26.4	24.4	I10
30	142	53	.23	.11	1.19	1.30	1.19	1.23	.43	.35	7.5	24.4	I59
10	144	53	.21	.11	1.03	.24	1.06	.45	.24	.35	24.5	23.7	I17
2	149	53	.15	.11	1.02	.16	1.00	.04	.41	.36	28.3	23.5	I2
25	149	53	.15	.11	1.02	.22	1.02	.20	.38	.36	28.3	23.5	I47
1	150	53	.14	.11	.80	-1.49	.80	-1.45	.36	.36	28.3	23.5	I1
27	153	53	.10	.11	1.05	.41	1.04	.32	.48	.36	24.5	23.7	I51
28	160	53	.01	.11	1.02	.19	1.01	.15	.40	.36	26.4	24.2	I53
4	164	53	-.03	.11	1.09	.67	1.09	.66	.38	.36	18.9	25.4	I5
14	169	53	-.10	.11	1.11	.77	1.13	.88	.29	.36	28.3	25.9	I25
31	178	53	-.21	.11	.76	-1.65	.74	-1.76	.51	.35	39.6	27.5	I60
18	179	53	-.22	.11	.96	-.19	.93	-.40	.47	.35	28.3	28.1	I33
11	182	53	-.26	.11	.94	-.31	.97	-.14	.26	.35	24.5	28.4	I19
3	192	53	-.40	.12	1.05	.33	1.08	.48	.29	.34	32.1	31.8	I3
17	195	53	-.44	.12	1.08	.50	1.08	.46	.14	.34	34.0	31.8	I30
29	198	53	-.49	.12	.61	-2.50	.58	-2.52	.46	.33	47.2	32.6	I54
9	201	53	-.53	.12	1.20	1.06	1.21	1.06	.14	.33	24.5	33.2	I12
6	204	53	-.58	.13	1.10	.57	1.08	.43	.22	.32	41.5	33.5	I8
13	205	53	-.60	.13	.98	-.05	.98	-.04	.11	.32	43.4	33.8	I24
20	205	53	-.60	.13	.74	-1.42	.77	-1.11	.25	.32	45.3	33.8	I36
23	220	53	-.88	.15	1.18	.82	1.09	.42	.27	.29	32.1	36.6	I41
MEAN	160.5	53.0	.00	.12	1.00	.0	.99	.0			28.7	27.8	
P.SD	30.6	.0	.41	.01	.15	1.0	.15	.9			8.6	4.5	

Figure 2. Item Measure Adversity Quotient Questionnaire

Figure 3. is wright map of HOTS math problem-solving competence which shows that 2 students, namely numbers 052 and 090 were on the top which means that the student's competence to answer questions is high and 17 students, namely numbers 008, 064, 002, 018, 020, 040, 047, 093, 039, 041, 049, 079, 004, 027, 087, 009, 011 are under the standard deviation which means that students' competence to answer questions is low. In addition, all test items are in the moderate category.
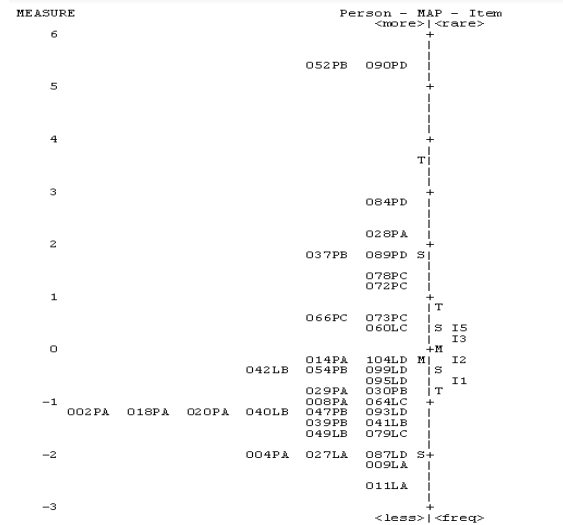

Figure 3. Wright Map HOTS Math Problem-Solving Competence

Meanwhile, Figure 4 is a test measure item that shows the students' competence level in answering questions and the difficulty of the question items. Item number I5 is on the top order, which means that this item has a high difficulty level compared to other items and the total score obtained is 210, the lowest score compared to the total score of other items, and there is a total count of 36 which means that students answering the item are 36 persons, *Outfit MNSQ, ZSTD,* and *PT-MEASURE CORR* columns are used by researchers to see whether the data is valid or not based on Rasch model criteria.

Item STATISTICS: MEASURE ORDER

ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	ZSTD	OUTFIT MNSQ	ZSTD	PTMEASUR-AL CORR.	EXP.	EXACT OBS%	MATCH EXP%	Item
4	210	36	.45	.11	1.49	1.74	1.33	1.32	.80	.84	22.2	29.6	I5
3	228	36	.22	.11	1.03	.21	.97	-.06	.84	.83	25.0	30.9	I3
2	259	36	-.16	.11	.72	-1.16	.82	-.70	.83	.79	27.8	30.6	I2
1	286	36	-.52	.12	.72	-1.11	.73	-1.13	.77	.77	36.1	32.2	I1
MEAN	245.8	36.0	.00	.11	.99	-.1	.96	-.1			27.8	30.8	
P.SD	29.1	.0	.37	.00	.32	1.2	.23	.9			5.2	.9	

Figure 4. Item Measure Test of HOTS Math Problem-Solving Competence

Student Interview

This interview was conducted to confirm the answers and data collected from the results of students' competence. Questions were given to 3 students based on the logit value which stated the categories of low competence (A1), medium competence (A2), and high competence (A3) through the following table:

Table 6. Student Interview Results

Q=	Did you understand the questions that have been given?	Q=	Did you understand the questions that have been given?	Q=	Did you understand the questions that have been given?
A_1=	I was actually confused, it was difficult.	A_2=	Understand a little bit.	A_3=	Quite understand.
Q=	When you did the questions, what did you do to understand the questions?	Q=	When you did the questions, what did you do to understand the questions?	Q=	When you did the questions, what did you do to understand the questions?
A_1=	I was thinking, I read it first.	A_2=	Read it over and over again until you understand.	A_3=	Read it over and over again, then I write what I know from the question.
Q=	What information did you find from the questions?	Q=	What information did you find from the questions?	Q=	What information did you find from the questions?
A_1=	I didn't know.	A_2=	What is in the question, I will write again (student mentions what is known).	A_3=	(Students say what they know and are asked about the questions completely).
Q=	Is there anything that make you confused from the questions that have been given? If yes, what make you confused?	Q=	Is there anything that make you confused from the questions that have been given? If yes, what make you confused?	Q=	Is there anything that make you confused from the questions that have been given? If yes, what make you confused?
A_1=	Yes, I was confused about how to do it.	A_2=	Yes, I like to forget the formula.	A_3=	There isn't any.
Q=	Why did you choose this method to solve the problem?	Q=	Why did you choose this method to solve the problem?	Q=	Why did you choose this method to solve the problem?
A_1=	I followed my friends.	A_2=	I think this is right.	A_3=	It's been taught by the teacher.
Q=	Did you look for another methods to answered the questions?	Q=	Did you look for another methods to answered the questions?	Q=	Did you look for another methods to answered the questions?
A_1=	I did, but when I didn't know and the time was running out i answered it randomly or asked my friends.	A_2=	Trying to find another answer.	A_3=	Yes, sometimes ask the teacher.
Q=	After you answered the questions that have been given, did you re-check the answering method you used?	Q=	After you answered the questions that have been given, did you re-check the answering method you used?	Q=	After you answered the questions that have been given, did you re-check the answering method you used
A_1=	I did check, but just looked at the answers; I didn't read the questions again.	A_2=	Yes, I read again.	A_3=	Yes, usually check again.

Q=	What was the conclusion from the questions that you have answered?	Q=	What was the conclusion from the questions that you have answered?	Q=	What was the conclusion from the questions that you have answered?
A₁=	I asked my friends.	A₂=	I never wrote a conclusion.	A₃=	Based on the answer.

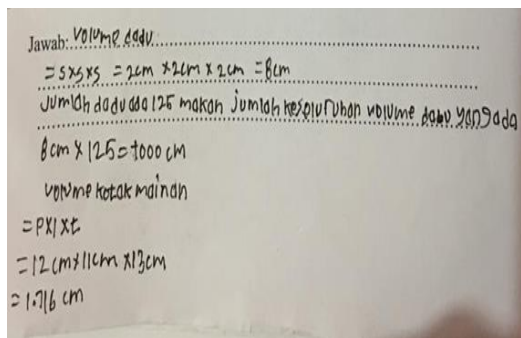## Problem Solving Competence HOTS Mathematics Questions for Quitter Type Students

Figure 5. Quitter Type Subject Answer

In Figure 5, it can be seen that subject 009 is categorized as having low competence; this subject could not solve the problem according to Polya problem-solving competence indicator. This subject did not write what known and asked from the question. Subject 009 only wrote the solutions to the questions given, but during the interview, the solution was obtained from a friend's answer, not from his/her own answer, it means that subject 009 did not know how to make plan and how to solve the problem. In accordance with the opinion of (Irianti et al., 2016), quitter-type students cannot mention information from the problem nor the solution well, these students give up easily, rely on other people's answers, and are unsure about their own competences. Subject 009 also did not answer the questioners correctly that makes person and item not fit.

Problem Solving Competence HOTS Mathematics Questions for Camper Type Students
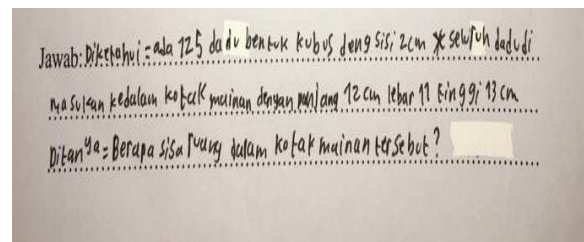
Figure 6. Camper Type Subject Answer

Based on the results of this research, it was found that the students' adversity quotient was camper-type, on the average. Subject 099 belongs to camper-type of adversity quotient category. The problem-solving competence of a camper-type student can be seen in Figure 6 in subject 099. Camper-type students could find out information contained in the problem, was able to plan the solution strategy even though it was not complete, did not write the completion steps, also did not write conclusions, even though camper-type students still made efforts to complete and did not depend on friends' answers. According to (Masfingatin, 2013), camper-type students sometimes need time to read repeatedly in order to understand the question which means that camper-type students were still trying to answer the questions given, this is in line with the interview that states that camper-type students need to read repeatedly to understand the question. Meanwhile, according to (Fatmahanik, 2018), in identifying problems, camper-type students need to fight persistently so that they are able to solve math problems.

Problem Solving Competence HOTS Mathematics Questions for Climber Type Students
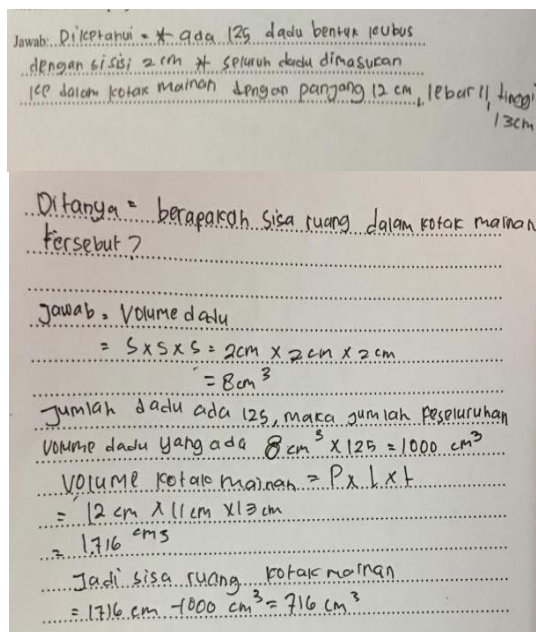

Figure 7. Climber Type Subject Answer

It can be seen in Figure 7. Subject 090 was able to solve the problem according to Polya HOTS problem-solving indicators. From the answers, subject 090 was able to identify the information contained in the questions, understood the problems, planned strategies, and solved problems even though the solution was incomplete, and tried to write conclusions. Based on the interview results, climber-type students wrote what known and what asked according to the information in the question before looking for the answer using a formula. In line with the research conducted by (Fatmahanik, 2018), climber- type students' focus tend to be good in understanding problems and planning problem solving strategies. However, in this research, students with high competence in answering questions did not necessarily have good competence to respond the adversity quotient questionnaires statements, it can be seen in figure 1. wright map adversity

quotient questionnaire that there are no students who occupy high quality competence in answering the questionnaire statements. In line with the results of research (Hadi, 2019) that the average student is in the adversity quotient camper type in solving HOTS questions but there is no relationship between students' problem solving competence and the types of adversity quotient students in mathematics.

CONCLUSION

Based on the research findings and discussion, it can be concluded that the problem solving ability of HOTS questions of climber type students is able to fulfill almost all indicators of problem solving ability according to Polya. Climber type students try to solve the problem completely. In this study, the average student was in the camper type in answering problem-solving competence questions and answering adversity quotient questionnaires, students in the camper type could only understand the problem but were not able to plan a solution strategy, but there were still efforts made to answer the questions. While the quitter type students answer questions depending on the answers of friends, there is no effort and motivation to understand the questions and plan a settlement strategy.

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