

## Mathematical Literacy Analysis of Class XI Students of the PISA Model in View of Adversity Quotient (AQ)

Elisabet Putri Wardani\*, Herry Agus Susanto, Erika Laras Astutiningtyas  
Mathematics Education Departement, Universitas Veteran Bangun Nusantara, Indonesia  
\*elisabet.p.wardani@gmail.com

### ABSTRACT

This study aims to describe the mathematical literacy of grade XI students of SMA Negeri 2 Karanganyar in solving the PISA problem model in terms of the Adversity Quotient. For some students, mathematical concepts can be difficult to grasp, causing frustration and disinterest with the subject. For others, external factors such as lack of resources, inadequate teaching methods, and inadequate support can contribute to poor math performance. This research is included in qualitative research. The data used were obtained from test results and interviews. The subjects of the study were carried out by grade XI students of SMA Negeri 2 Karanganyar. Data analysis procedures in this study are data collection, power reduction, data presentation, and conclusion pulling. Checking the validity of power in this study using triangulation techniques/methods. The results showed that (1) Students with climber type AQ were able to explain answers fluently and clearly, able to mention after facts, solve problems with simple strategies in solving problems. (2) Students with campers-type AQ are capable and some are unable to explain answers fluently and clearly, solving problems with simple strategies in solving problems. The types "climber" and "camper" are often used to describe patterns of behavior that can be observed in the context of AQ, there may not be a "quitter" type listed because the main focus of AQ is on the positive and adaptive aspects of facing challenges and difficulties.

**Keywords:** Adversity Quotient, Mathematical Literacy, Programme for International Student Assessment.

### ABSTRAK

Penelitian ini bertujuan untuk mendeskripsikan literasi matematis siswa kelas XI SMA Negeri 2 Karanganyar dalam menyelesaikan model soal PISA yang ditinjau dari Adversity Quotient. Penelitian ini termasuk dalam penelitian kualitatif. Data yang digunakan diperoleh dari hasil tes dan wawancara. Subjek penelitian dilakukan pada siswa kelas XI SMA Negeri 2 Karanganyar. Prosedur Analisis data dalam penelitian ini adalah pengumpulan data, reduksi daya, penyajian data, dan penarikan kesimpulan. Pemeriksaan keabsahan daya pada penelitian ini menggunakan triangulasi teknik/metode. Hasil penelitian menunjukkan bahwa (1) Siswa dengan AQ tipe *climber* mampu menjelaskan jawaban dengan lancar dan jelas, mampu menyebutkan susai fakta, memecahkan masalah dengan strategi sederhana dalam menyelesaikan soal. (2) Siswa dengan AQ tipe *campers* ada yang mampu dan ada yang tidak mampu dalam menjelaskan jawaban dengan lancar dan jelas, memecahkan masalah dengan strategi sederhana dalam menyelesaikan soal. Tipe "*climber*" dan "*camper*" sering kali digunakan untuk menggambarkan pola perilaku yang dapat diamati dalam konteks AQ, mungkin tidak ada tipe "*quitter*" yang tercantum karena fokus utama AQ adalah pada aspek positif dan adaptif dalam menghadapi tantangan dan kesulitan.

**Kata kunci:** Adversity Quotient, Literasi Matematika, Program Penilaian Siswa Internasional.

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### Introduction

The young generation who is reliable, has critical, methodical, logical and creative thinking, and has the will to work together must be equipped to operate effectively from an early age in the era of globalization (Khanifah & Purwosetiyono, 2019). Education plays an important role in the development and progress of a country. Education is expected to be able to equip students with the capacity or expertise to apply information and skills in overcoming difficulties in everyday life. Explained that learning mathematics must be designed so that students acquire mathematical skills such as the ability to understand, communicate, connect, reason, and solve mathematical problems (Junaedi & Asikin, 2012).

The Organization for Economic Development and Cooperation (OECD, 2016) defines mathematical literacy as "comprehending the practical roles of mathematics in real-life situations, problem-solving, applying mathematical concepts in different contexts, and constructing mathematical assertions" is defined as interpreting and using mathematics rationally. The PISA survey was conducted by the OECD as one of the ongoing international surveys. The development of international education can be seen through Indonesia's participation in TIMMS (International Survey of Mathematics and Science) and PISA.

Indonesia participates in every survey conducted by PISA. In the 2018 PISA survey, Indonesian students' math scores were ranked 72nd out of 78 countries with an average score of 379. The 2018 PISA assessment yielded data of around 28% of Indonesian students reaching level 2. The 2018 PISA survey results showed that less than 50% of students Indonesia can only reach level 2. Meanwhile, the questions tested in PISA consist of 6 levels (the lowest level 1 and the highest level 6) and the questions tested are contextual questions, the problems are taken from the real world. In percentage terms, only about 25% of Indonesian students have the ability to read above the minimum, only 24% have mathematics above the minimum, and around 34% of Indonesian students have science above the minimum (Nur'aini et al., 2021). This is a reference that Indonesia has low mathematical literacy (OECD, 2014).

Literacy is also a topic of discussion and research area in several countries. Several studies in Indonesia found that students in various locations had poor reading skills, such as research conducted (Khoirudin et al., 2017), the results obtained in the category of mathematical knowledge only reached level 1. These results were also influenced by several factors, including: 1) material selection, 2) teacher learning content, 3) educational environment, 4) a supportive home environment, 5) willingness to take tests, 6) ability to identify problems and facts faced by each student. Climbers are those who choose to survive to fight various types of things that will continue to hit, whether in the form of issues, challenges, obstacles, or other things that are obtained daily. Campers are those who have the desire to face current difficulties and challenges but give up because they believe that they are no longer competent. Quitters are those who lack the motivation to face obstacles in their lives. Those who belong to the "give up" group tend to avoid problems. Research on mathematical literacy in AQ-based contextual problem solving and found that climber students had better literacy skills than camper and quitter students (Mena, 2016).

On the other hand, study of mathematical literacy found that the mathematics literacy of high school students is still at a low level (Hertiandito, 2016). Students think that solving math problems by following or imitating the steps/strategies that have been taught by the teacher (Yustianingsih et al., 2017). While mathematical literacy ability is an individual ability that includes the ability to formulate, apply, and interpret mathematics in various contexts involving mathematical reasoning and the use of mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena, as well as relate them to everyday life (Annisa Indrawati, 2019), and the Adversity Quotient is used to help individuals improve their talents and tenacity in overcoming the challenges of daily life while staying true to their ideals and ambitions no matter what (Dhanita & Hidayat, 2015).

In observations at SMA Negeri 2 Karanganyar, many students struggle with mathematical literacy. For some students, math concepts can be difficult to grasp, leading to frustration and disinterest with the subject. For others, external factors such as lack of resources, inadequate teaching methods and inadequate support may contribute to poor math performance. The large

number of students who easily give up when working on questions that are too difficult is also related to the low adversity quotient attitude of these students (Wicaksono, 2020).

States that the Adversity Quotient is a predictor of success in facing difficulties, how to act in difficult situations, how to control situations, being able to find the true cause of problems, being responsible for these situations and limiting the consequences of these difficulties tried, and finally resolved how optimistic he was (Phoolka, 2012). States that the Adversity Quotient has three levels, namely climber, camper, and quitter (Stoltz, 2007:18). Research which states that climbers type students in solving problems are able to write down information that is known and asked correctly (Wahyuningsih, 2019).

Based on students in the climber category performed better in mathematics than students in the camper and quitter categories while students in the camper category have the same mathematical achievement as the quitter category (Wicaksono, 2020). The purpose to be achieved in this study is to describe the mathematical literacy of grade XI students with the PISA question model reviewed by the Adversity Quotient at SMA Negeri 2 Karanganyar. Based on some of the research above, it is encouraging to conduct research on the mathematical literacy abilities of class XI students using the PISA model of questions in terms of Adversity Quotient.

### **Research Methods**

The research method used in this study is descriptive qualitative research, which is based on the postpositivist philosophy. The data collection technique in this study is the Adversity Response Profile (ARP) Questionnaire used in this study to classify the Adversity Quotient (AQ). This ARP was developed by Stoltz and tends to be used to measure employee AQ. In this study, the participants were grade XI students of SMA Negeri 2 Karanganyar, therefore using ARP questionnaires based on student situations. ARP is given to students to determine their AQ level, as well as the type of quitters, campers, or climbers, Mathematical literacy ability test (PISA test) Literacy ability test as a measurement where researchers use various questions to measure students' abilities as an assessment of their abilities in writing, interviews, and documentation. Qualitative research is employed to investigate natural object conditions, using the researcher as the primary instrument for data collection. Triangulated data collection techniques are used, and data analysis is inductive and qualitative in nature. The results of qualitative research emphasize meaning rather than generalization (Sugiyono, 2013). The objective of this study is to describe the mathematical literacy abilities of class XI students using the PISA model of questions in terms of adversity quotient (climbers, campers, and quitters). The qualitative descriptive approach is chosen because it is superior to non-qualitative strategies in obtaining descriptive information through written or oral data collection (Nurhikmah, 2019).

### **Result and Discussions**

There were 23 students with AQ of the campers type, and 9 students with AQ of the climbers type. Furthermore, each student for each type was selected by purposive sampling (Sugiyono, 2013) based on the results of the Adversity Response Profile (ARP) test and other considerations including student involvement in learning, students' ability to express opinions or thoughts both orally and in writing, and class XI students received material on transformation and application of series (Table 1).

**Table 1.** Adversity Quotient Type Grouping

No.	Adversity Quotient Type	Number of Students
1.	Quitters	0
2.	Campers	23
3.	Climbers	9

Determination of subjects in this study were not chosen randomly, but used a purposive sample selection technique, namely with several considerations including odd semester test scores, students' activeness in learning, students' ability to express opinions both orally and in writing. The sample aims to focus on selected informants. Sampling was carried out deliberately in accordance with the researchers' objectives with the necessary sample requirements. That is, the researcher determined the sample himself which was taken because of certain considerations, namely the researcher took a sample that truly represented the Adveristy Quotient type, both campers and climbers. Of the 32 prospective students who will be the subject of this study, 4 students in class XI MIPA 6 SMA Negeri 2 Karanganyar with details of each group consisting of 2 students of the campers type and 2 students of the climbers type.

### *Climbers Type Subject*

$$\begin{aligned}
 & a \\
 & b = 2a \\
 & \downarrow \\
 & U_n = a + (n-1)b \\
 & \dots \\
 & U_1 + U_3 + U_5 + U_7 + U_9 = 90 \\
 & a + a + 2b + a + 4b + a + 6b + a + 8b = 90 \\
 & 5a + 20b = 90 \\
 & \text{E1} \quad \begin{aligned} 5a + 20b &= 90 \\ 5a + 20(2a) &= 90 \\ 45a &= 90 \end{aligned} \\
 & a = \frac{90}{45} \\
 & a = 2 \\
 & b = 4 \\
 & U_n = a + (n-1)b \\
 & U_n = 2 + (n-1)4 \\
 & U_n \rightarrow \\
 & \begin{aligned} b &= U_2 - U_1 \\ b &= U_{10} - U_8 \\ b &= \end{aligned} \\
 & a + 7b + a + 11b + a + 13b + a + 15b \\
 & 5a + 55b \\
 & 5(2) + 55(4) \\
 & 10 + 220 \\
 & = 230
 \end{aligned}$$

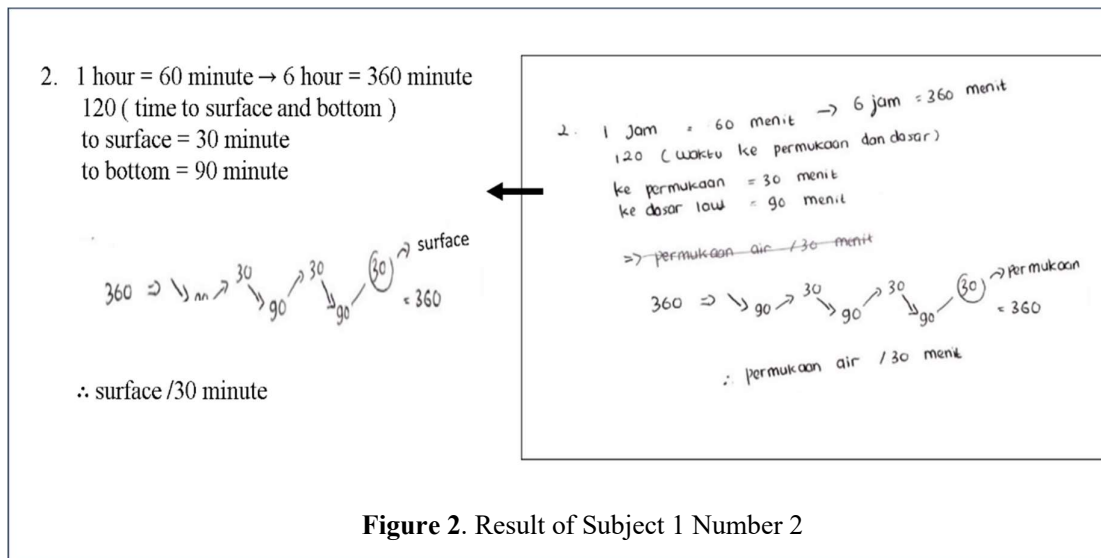
**Figure 1.** Result of Subject 1 Number 1

Based on the subject worksheet above (Figure 1), it can be seen that subject 1 was able to answer in good steps and was able to answer the test correctly. The following is an excerpt of the dialogue between the researcher and subject 1 (Table 2).

**Table 2.** Subject 1 Interview Excerpt

Subject	Researcher questions and subject answers
Questions	Do you understand the meaning of question 1?
Subject 1	I understand (nods understanding)
Questions	How to do it?
Subject 1	In that question, it is known that there is an arithmetic form that is $U_1 + U_3 + \dots = 90$ , $b = 2a$ , and looking for the value $U_8 + U_{10} + \dots$ . For $U_1$ , I explained it to form $a + (n - 1)b$ , and found a form with the variables $a$ and $b$ , then I replaced variable $b$ with $b = 2a$ . and find values $a = 2$ and $b = 4$
Questions	Yes, what are you looking for?
Subject 1	then put it into the equation you are looking for $U_8 + U_{10} + \dots$ . I also changed it to the form $a + (n - 1)b$ and found this result 230 (while pointing at the answer on the answer sheet)

Based on the interview excerpts, it can be seen that subject 1 was able to explain the steps that had been written on the answer sheet smoothly and answered correctly, using the working procedure. Subjects were able to answer the test with original or factual ideas, and were able to answer the test in sufficient detail and explain the stages of completion by developing their ideas.



**Figure 2.** Result of Subject 1 Number 2

Based on the subject worksheet above (Figure 2), it can be seen that subject 1 was able to answer in good steps and was able to answer the test correctly. The following is an excerpt of the dialogue between the researcher and subject 1 (Table 3).

**Table 3.** Subject 1 Interview Excerpt

Subject	Researcher questions and subject answers
Subject 1	It changes the time first
Questions	How was it changed?
Subject 1	It's a matter of asking where after 6 hours of observation the position is
Questions	He'em so?

Subject	Researcher questions and subject answers
Subject 1	Hold on to multiple captions in a matter of minutes. So 6 hours I change it to 360 minutes.
Questions	The whale swims to the bottom of the sea for 90 minutes, and returns to the surface for 30 minutes. To make it easier for me to make a graph like this.
Subject 1	Ok, make a graph up and down, right?
Questions	Yes, a graph is made, up and down the whale is 120 minutes. So the time in the 360th minute is its position on the surface
Subject 1	Where can you get the first rarity in the first 90 minutes?
Questions	From the question, it says that "at the beginning of the observation the satisfied position is on the surface". So if we go back to the basics, we count the first 90 minutes.

Based on the interview excerpts, it can be seen that subject 1 was able to explain the steps that had been written on the answer sheet smoothly and answered correctly, using the working procedure. The subject is able to answer the test with original or factual ideas, and is able to answer the test in sufficient detail and explain the stages of completion by developing his ideas.

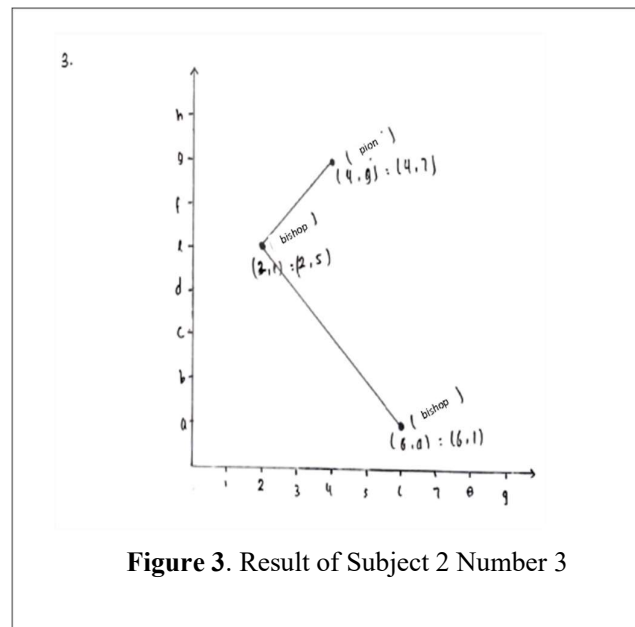


Figure 3. Result of Subject 2 Number 3

Based on the subject worksheet above (Figure 3), it can be seen that subject 1 was able to answer in good steps and was able to answer the test correctly. The following is an excerpt of the dialogue between the researcher and subject 2 (Table 4).

Table 4. Subject 2 Interview Excerpt

Subject	Researcher questions and subject answers
Questions	Ok, continue to number 3. Can you explain this Cartesian?
Subject 2	He'em. So, Miss. My version of the minister's position is at point $(6, A) = (6, 1)$ , then shifts to point $(2, E) = (2, 5)$ . Soldier's position advances 1 square to point $(4, G) = (4, 7)$ . So from point $(2, E)$ the minister can eat soldiers
Questions	Ok, why do you prefer to move towards $(2, E)$ ?
Subject 2	Time to look more towards the left, Miss.

Based on the interview excerpts, it can be seen that subject 2 was able to explain the steps that had been written on the answer sheet smoothly and answered correctly without using lengthy procedures. Subjects were able to answer the test with original or factual ideas, and were able to answer the test with insufficient detail and explain the stages of completion by developing their ideas. The subject has an independent nature in answering this question.

*Campers Type Subject*

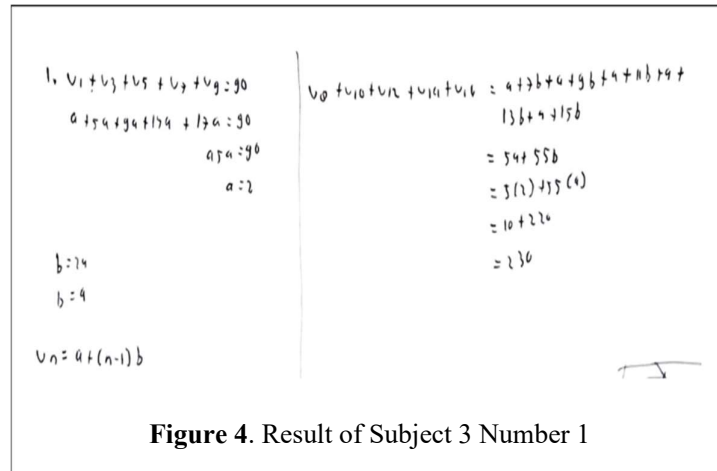


Figure 4. Result of Subject 3 Number 1

Based on the subject worksheet above (Figure 4), it can be seen that subject 2 was able to answer in good steps and was able to answer the test correctly. The following is an excerpt of the dialogue between the researcher and subject 3 (Table 5).

Table 5. Subject 3 Interview Excerpt

Subject	Researcher questions and subject answers
Questions	Maybe you can tell me how?
Subject 3	From $U_1 + U_3 + U_5 + U_7 + U_9 = 90$ then there is a statement that $b = 2a$ . So for example, $U_3$ is $a + 2b = a + 2.2a = 5b$ . I changed the series so that $a + 5a$ then met the value $a = 2$ then $b = 4$
Questions	Keep going?
Subject 3	I changed the $U_8$ series onwards to the form $a + (n - 1)b$ , then entered the values for a and b and found the result 230

Based on the interview excerpts, it can be seen that subject 3 was able to explain the steps that had been written on the answer sheet smoothly and answered correctly without using long procedures. Subjects were able to answer the test with original or factual ideas, and were able to answer the test in sufficient detail and explain the stages of completion by developing their ideas. The subject has an independent nature in answering this question.

Based on the subject worksheet at figure 5, it can be seen that subject 4 was able to answer with good steps even though the final results obtained were not correct. The following is an excerpt of the dialogue between the researcher and subject 4 (Table 6).

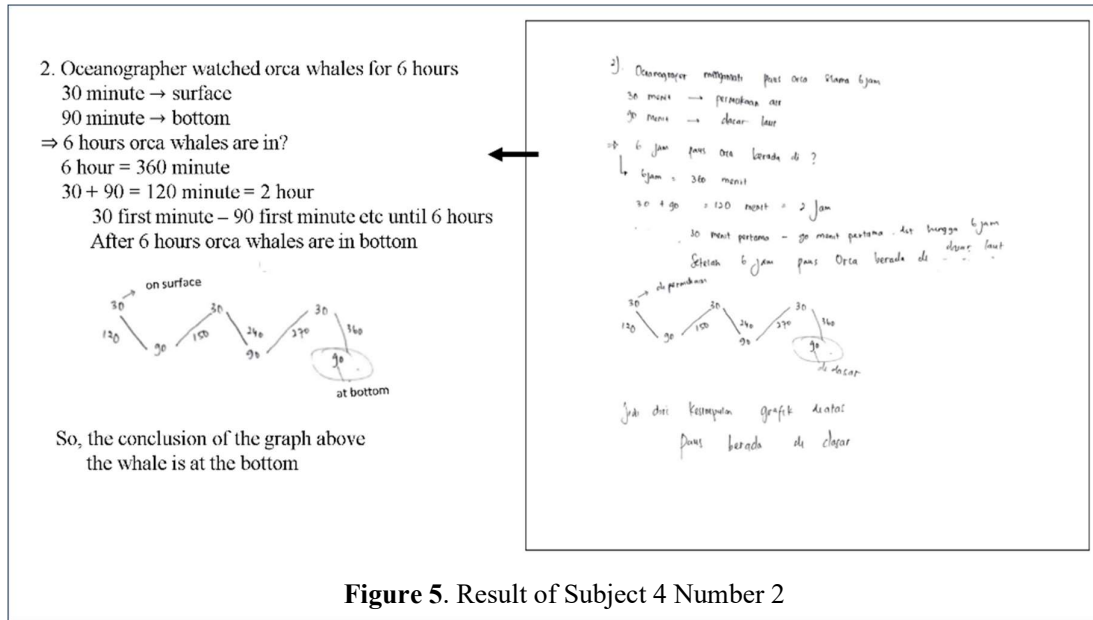


Figure 5. Result of Subject 4 Number 2

Based on the interview excerpts (Table 6), it can be seen that subject 4 was able to explain the steps that had been written on the answer sheet smoothly and even though the results obtained were not correct. The subject is able to answer the test with original or factual ideas, and is able to answer the test in sufficient detail and explain the stages of completion by developing his ideas.

Table 6. Subject 4 Interview Excerpt

Subject	Researcher questions and subject answers
Questions	Ok, question number 2. Can you explain what you wrote first?
Subject 4	From that, I will make a few points
Questions	He'em what's that?
Subject 4	The oceanographer observed for 6 hours. Then base to surface it's 30 minutes, from surface to bottom 90 minutes
Questions	Keep going?
Subject 4	Then from the first 30 minutes, the first 90 minutes if you add up 120 minutes = 2 hours. That means counting the first 30 minutes, the first 90 to 6 hours, I use the help of the whale rising and falling chart, the time at 360 minutes is at the bottom
Questions	Ok. The result is based on what do you think?
Subject 4	Yes
Questions	I want to ask this part. Why start from the first 30 minutes? (points on chart)
Subject 4	The question says "Then from the bottom the whale swims to the surface", so the first 30 minutes are counted

Based on the subject worksheet at figure 6, it can be seen that subject 3 was able to answer in good and correct steps. The following is an excerpt of the dialogue between the researcher and subject 3 (Table 7).

3. Materi : diagonal.

$$\begin{pmatrix} 6 \\ 4 \end{pmatrix} \rightarrow \begin{pmatrix} 8 \\ 6 \end{pmatrix} \rightarrow \begin{pmatrix} 4 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x+2 \\ y+2 \end{pmatrix} = \begin{pmatrix} x \\ y \end{pmatrix} \begin{pmatrix} 8 \\ 6 \end{pmatrix}$$

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} x-4 \\ y+4 \end{pmatrix} = \begin{pmatrix} x \\ y \end{pmatrix} \begin{pmatrix} 4 \\ 7 \end{pmatrix}$$

$$= \begin{pmatrix} 4 \\ 7 \end{pmatrix} \begin{pmatrix} 4 \\ 6 \end{pmatrix}$$

**Figure 6.** Result of Subject 4 Number 3

Based on the excerpts of the interview (Table 7), it can be seen that subject 3 was able to explain the steps that had been written on the answer sheet smoothly and answered correctly without lengthy procedures. Subjects were able to answer the test with original or factual ideas, and explained the stages of completion by developing their ideas. The subject has an independent nature in answering this question

**Table 7.** Subject 3 Interview Excerpt

Subject	Researcher questions and subject answers
Questions	Can you explain for number 3? Have you tried using the translation formula?
Subject 3	Yes
Questions	Ok, how about this?
Subject 3	The first one I translate with point (2,2), So point (6,1) is translated with point (2,2) the result is (8,3)
Questions	He'em, so ?
Subject 3	Continue from (8,3) to be translated again at the point (-4,4) so (4,7)
Questions	The conclusion?
Subject 3	In conclusion, the minister's pattern from (6, A) to (8, C) continues to (4,7)
Questions	Why is there (4,6)?
Subject 3	Oh, misspelled Miss. Should (4,7)

**Table 8.** Mathematical Literacy Skills possessed by the Subject

Observed aspects	Subject 1	Subject 2	Subject 3	Subject 4
Literacy Skills Math on the problem PISA level 1	The subject is able to answer	The subject is able to answer	The subject is able to answer	The subject is able to answer
	Question number 1 correctly and the right reasons based on information Requirements on question.	Question number 1 correctly and the right reasons based on information Requirements on question.	Question number 1 correctly and the right reasons based on information Requirements on question.	Question number 1 correctly and the right reasons based on information Requirements on question.

Observed aspects	Subject 1	Subject 2	Subject 3	Subject 4
Literacy Skills Math on the problem PISA level 2	The subject is able to answer Question number 2 correctly based on the procedure or formulas in general.	The subject is able to answer Question number 2 correctly based on the procedure or formulas in general.	The subject is able to answer Question number 2 correctly Using the procedure self-workmanship (Independent)	The subject is able to answer Question number 2 correctly based on the procedure or formulas in general.
	The subject is able to answer Question number 3 correctly according to procedure however The results obtained are not quite right.	The subject is able to answer Question number 3 correctly Using the procedure self-workmanship (Independent).	The subject is able to answer Question number 3 correctly according to procedure however The results obtained are not quite right.	The subject is able to answer Question number 3 correctly Using the procedure self-workmanship (Independent).

Based on both tests that have been carried out by AQ learners with climbers, in line with research that says that subject climbers are able to take the information given about the problem and write it back in their own language (Chanifah, 2015).

Based on data obtained from the results of written tests and interviews, it was found that students with campers-type AQ were able and unable to explain their work written smoothly and correctly on the question. There are students who are able and unable to complete the test independently and in conveying ideas, as well as communicating with what they have done (Widyastuti, 2015).

### Conclusion

Based on the results of the analysis and discussion described, the following conclusions are obtained: 1) Students with AQ type climbers, namely students are able to explain answers fluently and clearly, are able to state appropriate facts, solve problems with simple strategies in solving these questions, 2) Students with AQ type campers, namely students who are able and some who are unable to explain answers smoothly and clearly, solve problems with simple strategies in solving these questions..

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