

# Mathematics Literacy Judging from Students' Adversity Quotient of the Tenth Grade at SMAN 1 Takalar

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## ABSTRACT

This research aimed to know the description of using Mathematics Literacy Ability based on the Student Adversity Quotient (AQ) of Climber Type at the tenth grade of SMAN 1 Takalar. The research method used is qualitative research. This research is a case study. The subjects of this research were students of class X MIA SMAN 1 Takalar who had an Adversity Quotient (AQ) specifically for the climber type and represented male and female students. The data processed was Adversity Quotient (AQ) data and students' mathematics literacy ability data. Data was collected by Adversity Response Profile (ARP) questionnaires to determine the type of Adversity Quotient (AQ) in students to determine research subjects, PISA (Program for International Student Assessment) questions, and interviews. The questions used to see students' mathematics literacy skills were about PISA (Programme for International Student Assessment), which is opened 3 each is level 1, level 2, and level 3. An interview was conducted to explore mathematics literacy skills and data accuracy further. Data analysis used the Miles and Huberman model, including data reduction, data presentation, and conclusion drawing/verification. Based on the study of the data, it was found that (1) the female climber type subject has excellent mathematics literacy skills because the subject can answer all question of PISA (Program for International Student Assessment) questions from level 1 to level 3 correctly (2) The male climber type have excellent mathematics literacy skills. After all, the subject can answer all questions of PISA (Program for International Student Assessment) from level 1 to level 3 questions correctly.

**Keywords:** *Mathematical Literacy Ability, PISA, Adversity Quotient, Climbers.*

## 1. INTRODUCTION

The Constitution number 20 of 2003 Chapter 1 Article 1 concerning the national education system, education is defined as a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed by himself, society, nation, and state. To achieve the goals and functions of national education, a supportive curriculum is needed to be given to students at the level of their respective educational units such as Elementary School (SD), Junior High

School (SMP), High School (SMP), High School (SMA) and Higher Education [1].

Curriculum as a bridge to the goal at every level of education is described in several school subjects. One of the subjects in the education syllabus at all levels is Mathematics. Mathematics education is an effort to improve students' mathematical abilities and improve students' intelligence. In this case, mathematical concepts are used as a tool to develop these mathematical abilities. According to the National Council of Teachers of Mathematics (NCTM), in 2000, there were five mathematical abilities in learning mathematics. These five abilities are abilities that must be mastered by students after

Learning mathematics, namely mathematical reasoning, mathematical representation, connections, mathematical communication, and mathematical problem-solving. Five abilities are supported by mathematical literacy skills called mathematical power. Therefore, mathematical literacy is referred to as the minimum ability a person has in mathematics that can be used to survive in the face of tasks of some expertise. This mathematical literacy makes it easier for someone to understand mathematics and apply it to make the right decisions [2].

PISA 2015 provides a formal definition of mathematical literacy, namely: Mathematical literacy is an individual's capacity to formulate, employ and interpret mathematics in various contexts. It includes reasoning mathematically and using mathematical concepts, procedures, facts, and tools to describe, explain and predict phenomena. It assists individuals in recognizing the role that mathematics plays in the world and makes the well-founded judgments and decisions needed by constructive, engaged, and reflective citizens [3].

This means that mathematical literacy is a student's ability to formulate, use and interpret mathematics in various contexts. This includes mathematical reasoning by using mathematical concepts, procedures, facts, and tools to describe, explain, and predict phenomena. This helps a person recognize the role of mathematics in life and make rational and logical judgments and decisions required by citizens who are constructive, actively engaged, and reflective.

Students' Mathematics Literacy Skills are assessed using international assessment studies, namely PISA. PISA is the OECD's Programme for International Students Assessment. PISA measures 15-year-old's ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges [5]. The PISA survey was organized by the OECD (Organization for Economic Cooperation Development), a part of the United Nations organization engaged in world economic development and headquartered in Paris, France. Indonesia has joined PISA (specifically in math literacy assessment) and other countries, such as Singapore, China, and the United Kingdom.

Table 1. Indonesia participation in PISA for 15 year

Year Study	Subject	Indonesian Rating	Score	Participants
2000	Mathematics	39	367	41
2003	Mathematics	38	360	40
2006	Mathematics	50	391	57
2009	Mathematics	61	371	68
2012	Mathematics	64	375	65
2015	Mathematics	63	386	72

## 2. RESEARCH METHODS

### 2.1. Subject and Research design

This research used a qualitative research method, while the research approach used is case studies. The purpose of this study was to describe the ability of mathematical literacy based on the Adversity Quotient (AQ) of Climbers Type Students in class X MIA SMAN 1 Takalar.

These research subjects are decided based on the ARP (Adversity Response Profile) questionnaire and interviews. The results of this questionnaire are students of class X MIA SMAN 1 Takalar who have Adversity Quotient (AQ) specifically for the Climbers Type and represent male and female students.

### 2.2. Instrument

The research instruments used in this study are ARP (Adversity Response Profile), Interview Guidelines, Mathematics Literacy Ability Test (PISA Test), and Recording Device. The ARP used was originally the standard ARP from Stoltz that had been translated. Still, after going through validation, the ARP questionnaire was considered too difficult to understand by the students. Hence, the author revised the questionnaire according to the direction of the validator but still guided by the standard ARP questionnaire.

Tabel 2. AQ Category based on ARP

Score	Category/type
>59	Quitters
60-94	Quitters – campers
95-134	Campers
135 – 165	Campers – climbers
166 – 200	Climbers

Source: Stoltz [4]

The test used is a collection of PISA (Program for International Student Assessment) questions that have been translated and adapted to the context and validated by validators. The PISA questions used are

PISA questions in 2012 starting from level 1, level 2, and level 3.

### 3. RESULTS AND DISCUSSION

#### 3.1. Result

Data from this study was revealed through tests and interviews on two research subjects based on gender. The subjects of this study were grade X MIA students of SMA Negeri 1 Takalar, male and female students who had Adversity Quotient type Climbers.

Climber-type subjects have been given a math literacy skills test, which in this case is PISA (Programme for International Student Assessment) level 1 to level 3.

#### 3.1.1 Female Adversity Quotient Subject of Campers Type

##### 3.1.1.1 Mathematics Literation of SP AQ at level 1

The following are pictures of test results and interview excerpts of female climber-type students on question number 1 level 1.

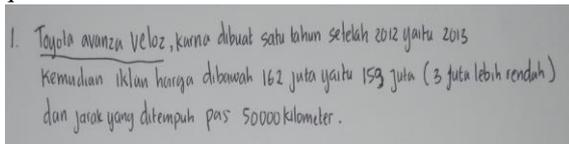


Figure 1 Test result number 1

In Figure 1 above, the female subject AQ climbers type answered the question correctly, namely the Toyota Avanza Veloz, because it was made one year after 2012, 2013. The ad was priced below 162 million, which is 159 million (3 million lower) and the distance traveled was 50000 kilometers, while in table 4.7. the subject answered the question correctly, namely Toyota Avanza Veloz (SP1-002), because it met the requirements in the question (SP1-003). The subject's answers from the PISA test results and interview excerpts on level 1 category questions are correct, and the reasons are correct (Figure 4.1, SP1-002 and SP1-003). From the data, it can be concluded that the female climber-type subject can answer level 1 questions.

##### 3.1.1.2 Mathematics Literation of SP AQ at Level 2

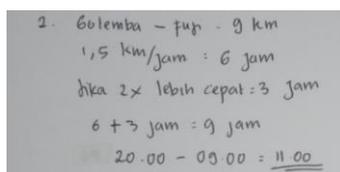


Figure 2 Test result number 2

Based on Figure 2 above, the female subject, AQ, the climber type, answered question number 2 correctly, 11.00. Their working procedure: gotemba – fuji = 9 km, 1.5 km/hour = 6 hours, If 2x faster = 3 hours, 6 + 3 hours = 9 hours, 20.00 - 09.00 = 11.00. While in table 4.8 above, the subject also answered question number 2 correctly, which is 'no later than 11.00 (SP2-003)', the subject quickly reads the question and explains smoothly, "The distance from gotemba to fuji is 9 km, then a pedestrian named Toshi estimates that he can climb a mountain with an average speed of 1.5 km / h, meaning to reach 9 km takes 6 hours, then he said he would reach twice as fast when going down. This means 2x faster than 6 hours which is 3 hours (meaning the same as 3 hours) (SP2-002). The subject thinks for a moment and rereads the question, then continues to explain smoothly, "eaaaa, twice as fast, your time is 2x faster if you go down; So, it means that if it's 2x faster than 6 hours, it means that it's going down. The time it takes to go down means 3 hours. So to go up and down to the top of the mountain takes 9 hours. Because climbers must return at 20.00 or 8 pm, climbers must start climbing at 11:00 at the latest at 11 (SP2-003). The subject's answer from the test results and interview excerpts on level 2 category questions are exactly at 11.00, but the SP subject has its procedure to solve question number 2 (Figure 4.2, SP2-002 and SP2-003). From the data, it can be concluded that the female subject is a type 2 climber, and she can answer level 2 questions.

##### 3.1.1.3 Mathematics Literacy of SP AQ at level 3

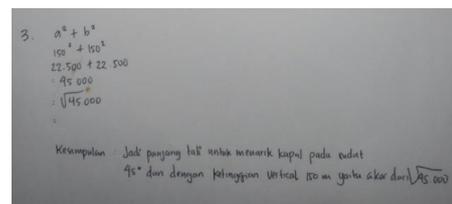


Figure 3 Test result number 3

Based on Figure 3 above, the female subject AQ with climber type answered  $\sqrt{45000}$  using the Pythagorean formula.  $a^2 + b^2 = 150^2 + 150^2 = 22500 + 22500 = 45000 = \sqrt{45000}$ . While in table 4.9, the subject answered  $\sqrt{45000}$  (SP3-006), the subject thought and then read the question and then gave an answer "Use the Pythagorean formula, keep squaring the number by 2,  $a^2 + b^2$ , because here it is

150 meters (vertical length), it is automatically to be  $90^\circ$  the angle which here is also 150 meters (horizontal length). That means  $150^2 + 150^2$  is  $22500+22500 = 45000$ , then we look for the root of 45000, but I don't get it" (SP3-004). The subject's answer from the test results and interview excerpts to the level 3 category question is to answer with the appropriate and correct procedure. The subject can use the Pythagoras formula but not complete the answer until the end. Only up to  $\sqrt{45000}$  (Figure 4.3, SP3-003, and SP3-005) from the data can conclude that the female subject climber type can answer the question level 3.

### 3.1.2 Female Subjects Adversity Quotient type campers

#### 3.1.2.1 Mathematics Literacy of SLAQ at

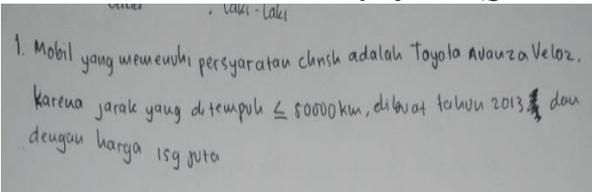


Figure 4. Test result number 1

In Figure 4. above, the male subject AQ climbers type answered the question correctly, namely the Toyota Avanza Veloz, because the distance traveled was 50000 km, made in 2013 and priced at 159 million. While in table 4.10, the subject answered the question correctly, namely a car that meets the requirements, Toyota Avanza Veloz (SL1-002). The subject immediately explained this by looking at the information served in the question. "Because it fits the requirements that Chris wants. First, the distance traveled is not higher than 50000 km, the Toyota Avanza Veloz meets the requirements. Then the second one was made in 2012 or a year later, and the Avanza Veloz was made in 2013. Then the advertised price is not higher than 162 million, which Toyota Avanza Veloz costs 159 million" (SL1-003). The subject's answers from the test results and interview excerpts on level 1 category questions are correct, and the reasons are explained clearly.

#### 3.1.2.2 Mathematics Literacy of SLAQ at level 2

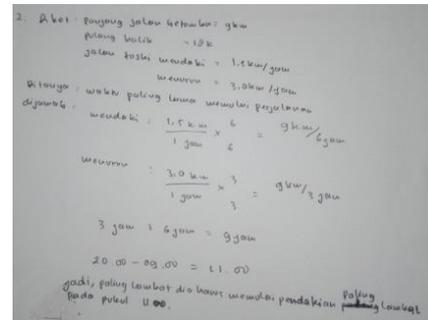
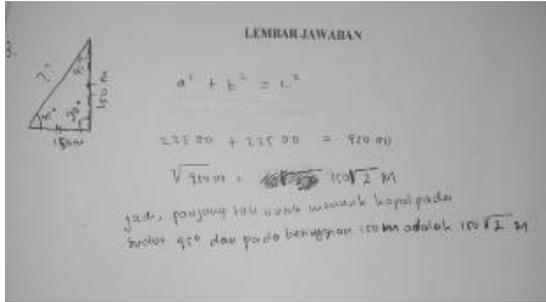


Figure 5. Test result number 2

Based on Figure 5, the male subject, AQ, climber type, answered question number 2 correctly, at 11.00. The procedure for the process is: Diket = length of the gotemba road = 9 km, return = 18 km, Toshi road climb = 1.5 km / hour, down = 3.0 km / hour. Asked = long return time to start the journey. Answer= hike =  $\frac{1,5 \text{ km}}{3,0 \text{ km}} \times \frac{6}{6} = 9 \text{ km} / 6 \text{ hour}$ , downhill =  $\frac{3,0 \text{ km}}{1 \text{ km}} \times \frac{3}{3} = 9 \text{ km} / 3 \text{ hour}$ , 3 hours + 6 hours = 9 hours,  $20.00 - 09.00 = 11.00$ , so he must start climbing at the latest which is at 11.00. While in table 4.11 above, the subject answered question number 2 correctly, which is 11.00. Because it is known here, the length of the road is about 9 km up, automatically going down 9 km means that the return road is 18 km. So if, according to Toshi, the road to climb is 1.5 km/hour, it means going down because here it is said to be 2 times faster, so I give it 3 km/hour. Continue to ask if using Toshi's estimate at what time he must start the climb to return at 20.00. So, first, I looked for how many hours it took when he climbed. After that, the 9 km divided by 1.5 km/hour gets 6, so I only need 1-hour x 6 = 6 hours to climb 9 km/6 hours. So to go down, it only needs 3 km/hour, then here 9 km divided by 3 km is 3, so I multiply 1-hour x 3 = 3 hours, so for downhill, it's 9 km/3 hours, so, 3 hours + 6 hours = 9 hours. Then I subtract  $20.00 - 9 \text{ hours} = 11.00$  at the latest (the subject is very fluent in explaining) (SL2-003). The subject's answer from the test results and interview excerpts on question number 2 level 2 is correct at 11.00. Using the appropriate formula in the processing procedure (Figure 4.5, SL2-003) from the data, it can be concluded that the male subject of the climber type can answer level questions. 2.

**3.1.2.3 Mathematics Literacy Skills of SL AQ at level 3**



**Figure 6. Test result number 3**

Based on Figure 6, male subjects AQ climber type answered  $150\sqrt{2}$  by using the formula Pythagoras.  $a^2 + b^2 = c^2$ ,  $22500 + 22500 = 45000 = \sqrt{45000} = 150\sqrt{2}$ . While in table 4.11, the subject answers  $150\sqrt{2}$  (SL3-003), the subject says, "As far as I know that the right triangle formula, formula to find the oblique side that is by using the formula Pythagoras or  $a^2 + b^2 = c^2$  because the vertical line is 150 meters and the angle here  $45^\circ$  and  $90^\circ$  then the first I have to determine the angle here (the top angle). In a triangle, the sum of all the angles is  $180^\circ$ , so I sum the  $45^\circ + 90^\circ = 135^\circ$ . So  $180^\circ - 135^\circ = 45^\circ$  because the angle is the same here as here, then the length is also here with the same (meaning the angle on the vertical and horizontal lines is the same as the length). So I need to put it in the Pythagorean formula, which is  $150^2 + 150^2 = 22500 + 22500 = \sqrt{45000}$  because I don't get an integer that fits so  $150\sqrt{2}$  meters" (SL3-002, SL3-003). The subject's answer from the test results and interview excerpts on question number 3, category level 3 is correct with a final result of  $150\sqrt{2}$  meters and the appropriate procedure using the Pythagorean formula (Figure 4.6, SL2-002). From the data, it can be concluded that the subject is a climber-type male able to answer level 3 questions.

**3.2. Discussion**

In this section, we will discuss the analysis of research data focused on several things, namely: the mathematical literacy ability of female students, Adversity Quotient climbers type, mathematical

literacy ability of male students Adversity Quotient climbers type, comparison of mathematical literacy ability of female students with climbers type mathematics literacy of climbers type male students.

**3.2.1 Mathematics Literacy Skills of Female Students of Adversity Quotient Climbers Type**

**3.2.1.1 Mathematics Literacy Skills of SP AQ category level 1**

In question number 1, which is a level 1 category, the subject can answer the question correctly and with the correct reason according to the information contained in the question.

**3.2.1.2 Mathematics Literacy Skills of SP AQ category level 2**

In question number 2, a level 2, the subject can answer questions correctly using his work procedure or how it works independently without using sequential formulas and long procedures. The subject has an independent nature in answering this question.

**3.2.1.3 Mathematics Literacy Skills of SP AQ category level 3**

In question number 3, a level 3 category, the subject answered the question with the appropriate and correct procedures and formulas. Still, the subject did not complete the procedure until the end, namely, until he found the result  $\sqrt{45000}$ . The subject determines the size of the angle and the length of the unknown side through his estimation. The subject also gives a conclusion sentence in the answer.

**3.2.2 Mathematics Literacy Skills of Male Student of Adversity Quotient Climbers Type**

**3.2.2.1 Mathematics Literacy Skills of SP AQ category level 1**

In question number 1, which is a level 1 category, the subject can answer the question correctly and provide the correct reason according to the information stated in the question.

**3.2.2.2 Mathematics Literacy Skills of SP AQ category level 2**

In question number 2, which is a level 2 category, the subject can answer the question correctly using the appropriate working procedure and formula in general.

### **3.2.2.3 Mathematics Literacy Skills of SP AQ category level 3**

In question number 3, category level 3, the subject can answer the question correctly according to the working procedure and the appropriate formula. The subject is very familiar with material related to the problem.

### **3.2.3 Comparison of Mathematics Literacy Skills of Female and Male Student of Adversity Quotient Climbers Type**

#### **3.2.3.1 SP and SL Mathematical Literacy Skills at level 1 category**

SP and SL can answer questions correctly with the right reasons according to the information contained in the questions.

#### **3.2.3.2 SP and SL Mathematical Literacy Skills at level 2 category**

SP and SL have the same final answer but are different in their working procedure. SP answered in their way or independently, while SL answered with the appropriate formula and procedure.

#### **3.2.3.3 Mathematics Literacy Skills SP and SL in level 3 Category**

SP and SL both can answer with the appropriate procedure. However, SL is very familiar with material related to questions compared to SP. SL also completes the procedure to the end, whereas SP does not.

(Independent) on question number 2. While male subjects answered using formulas, they were also more familiar with the material in the question and were more detailed in explaining the procedure.

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## **4. CONCLUSION**

Based on the results of research and data analysis that has been described in the previous chapter, it can be concluded as follows:

1. Female subjects with adversity quotient type climbers have high mathematical literacy skills for level 1 to level 3, which is indicated by the subject's ability to answer questions according to indicators.
2. Male subjects with adversity quotient type climbers have high mathematical literacy skills for level 1 to level 3; this is indicated by the subject's ability to answer questions according to indicators.
3. The difference between the two abilities lies in their steps in solving the problem. Female subjects answered in their way and estimates