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Investigating the Horizontal Mathematization Process for Students with Diverse Adversity Quotients in Solving PISA-Oriented Problems

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Abstract: Investigating the Horizontal Mathematization Process for Students with Diverse Adversity Quotients in Solving PISA-Oriented Problems. Objectives: This study aims to understand the horizontal mathematization process of students with climber, camper, and quitter types of Adversity Quotient (AQ) in solving PISA-oriented problems. **Methods:** This research employs a qualitative approach. Data was collected using questionnaires, written tests, and unstructured interviews. The data was analyzed through data reduction, presentation, and verification or conclusion. **Findings:** The research results indicate that students of SMP Negeri 9 Surakarta in the 2023/2024 academic year with a climber AQ type have already developed the ability to solve PISA-oriented problems using the horizontal mathematization process well. Students with a camper AQ type have already developed the ability to solve PISA-oriented problems reasonably using the horizontal mathematization process. Meanwhile, students with a quitter AQ type have not yet developed the ability to solve PISA-oriented problems using the horizontal mathematization process. **Conclusion:** Based on this research, students with a climber AQ type have a better or higher mathematical process than those with a camper or quitter AQ type.

Keywords: adversity quotient, horizontal mathematization process, PISA.

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INTRODUCTION

Mathematics is essential for developing logical, analytical, and problem-solving skills. One of the primary goals of mathematics education is the ability to mathematize, which involves translating real-world problems into mathematical models and vice versa. This aligns with Freudenthal's perspective (Gravemeijer & Terwel, 2000: 779), which emphasizes the importance of connecting mathematics to everyday life.

According to Kusmaryono & Kusumaningsih (2023: 1487), based on tests conducted by the Programme for International Student Assessment (PISA), students' mathematical abilities can be assessed. PISA results show that Indonesian students' performance in mathematics is still relatively low compared to other countries. The latest PISA data from 2022 shows that Indonesia ranked near the bottom, 69 out of 81 countries (OECD, 2023). This indicates a weakness in Indonesian students' ability to mathematize. Several studies have shown that Indonesian students struggle with modeling contextual problems and transforming real-world problems into mathematical forms.

Based on preliminary studies, students have difficulties solving problems involving mathematization. They often cannot connect real-

world situations with mathematical concepts, making it difficult to create appropriate mathematical models (Mudaly, 2004: 37). This suggests that students' mathematical processes still need improvement. Mathematization is transforming a real-world problem into a mathematical one and vice versa. This process consists of two main components: horizontal mathematization and vertical mathematization. The horizontal and vertical mathematization described by Treffers and Goffree (Hidayat et al., 2023: 3) can be linked to the stages of the mathematical process according to PISA. The activities in horizontal mathematization, which focus on the development of mathematical concepts, align with the first stage of PISA, where students are asked to identify mathematical concepts relevant to real-world problems. Horizontal mathematization transforms a contextual problem into a mathematical model, while vertical mathematization manipulates the mathematical model to obtain a solution. The indicators of horizontal mathematization processes are presented in Table 1.

Table 1. Indicators of horizontal mathematization processes

Mathematization Prosses	Indicators
Horizontal Mathematization	1. Students can identify mathematical concepts related to their contextual problems.
	2. Students can correlate problems with mathematical language (symbols, tables, graphs, images, etc.).
	3. Students can create mathematical models.

Given the poor mathematization skills of Indonesian students, teachers should emphasize contextual problems. The contextual problems teachers give should be oriented toward PISA questions, which can help improve students' ability to solve real-world problems at an international level. According to the Organisation for Economic Co-operation and Development (OECD) (Hasibuan et al., 2020: 2), PISA questions assess three main aspects: content (e.g., change and relationships, space and shape), context (e.g., personal, social), and competence (e.g., reproduction, connection, reflection).

The Adversity Quotient (AQ) is an individual's ability to cope with difficulties. Nashori (Septiana & Nurkhin, 2018: 804) suggests that the Adversity Quotient is an individual's ability to confront obstacles and challenges. When faced with adversity, they leverage their intelligence to guide and transform their thoughts and actions. According to Stoltz (Amir et al., 2017: 170), individuals can be categorized into three groups based on their AQ type. Stoltz (Dewi & Wutsqa, 2024: 637) states that these three types are climbers, campers, and quitters. People with a climber type are persistent in facing challenges, always seeing opportunities, finding hope in despair, and maintaining a strong drive for success. On the other hand, people with a camper type respond to challenges but tend to stop at a certain point, even if there are still many growth opportunities. Lastly, people with a quitter type choose to leave, avoid responsibilities, and withdraw when faced with difficulties. Table 2 presents the characteristics of each AQ type according to Stoltz (Juwita et al., 2020: 508).

This research focuses on students with climber, camper, and quitter types of AQ. The aim is to examine how students with this type of AQ are able to carry out the mathematization process in solving PISA questions.

Table 2. AQ characteristics

AQ Type	Characteristics
Climber	• Always prepared to face challenges; • Focuses solely on opportunities; • Highly confident; • Does not regret failures; • Understands their inner purpose; • Often uses phrases like "now is the time to act," "let's do it," or "there's always a way"; • They are rebels who won't give up.
Camper	• Sometimes misses out on opportunities for progress; • Very satisfied with what has been achieved; • Dislikes high-risk activities; • Unwilling to seek other opportunities and is more satisfied with the results obtained; • Often uses phrases like "that's enough for now" or "this is good enough"; • They choose to avoid challenges if they feel bored.
Quitter	• Avoids responsibilities; • Chooses to walk away from challenges; • Feels stressed, easily blames others, and resents those who continue to progress; • Finds it easy to give up; • Often uses phrases like "can't," "won't," "it's impossible," or "it can't be done"; • Unwilling to accept opportunities or chances.

METHOD

Research Type

This study employed a qualitative research design. Moleong (2016: 6) argues that qualitative research aims to understand phenomena holistically, including subjects' experiences, such as behavior, motivation, actions, perceptions, and others. It involves describing these phenomena using words and language, employing various natural methods in a specific context. The data used in this study is the mathematization process of students with AQ type.

Participants

The research was conducted from January to June 2024 at SMP Negeri 9 Surakarta. The research subjects were 32 eighth-grade students of SMP Negeri 9 Surakarta. The subjects were selected using purposive sampling. The determination of the research subjects was based on the view that eighth-grade students in the second semester have had adequate learning experiences. Subjects will be selected based on the research focus to determine the mathematical modeling process in solving PISA-oriented problems possessed by students with AQ type. The researcher categorized students with AQ type using the research data's average value and standard deviation. The classification of AQ level is presented in Table 3.

The results of the AQ type categorization in this study show that there were six students with a climber AQ type, 21 students with a camper AQ type, and five students with a quitter

Table 3. Classification of AQ types

Score	Type
$X > \overline{X} + SD$	Climber
$\overline{X} - SD \leq X \leq \overline{X} + SD$	Camper
$X < \overline{X} - SD$	Quitter

AQ type. This article presents data from 3 research subjects, each representing the category of AQ type.

Instruments

The instruments used in this research were questionnaires, tests, and interviews. The questionnaire used was an Adversity Quotient (AQ) questionnaire to collect data related to the AQ type of eighth-grade students at SMP Negeri 9 Surakarta. The researcher developed the questionnaire based on the theory proposed by Stoltz. Before constructing the questionnaire items, a blueprint was prepared for each AQ aspect: control, endurance, reach, origin, and ownership. The questionnaire framework is presented in Table 5.

This questionnaire was content-validated by a clinical psychologist and a guidance counselor. The questionnaire was piloted with students to

Table 5. Questionnaire framework for AQ

No	Dimension	Indicator	Positive Item Number	Negative Item Number	Number of Items
1	Control (C) This dimension aims to determine the extent to which an individual perceives control over a complex event.	a. Managing challenging situations.	1. 2. 3	4.5	5
		b. Recognizing challenging circumstances.	6.7	8	3
2	Origin dan Ownership (O2) This dimension inquires into two aspects: what or who is the cause of a difficulty, and to what extent an individual is capable of coping with the consequences of a difficult situation.	a. Knowing the reason for a problem.	9. 10. 12	11. 17	5
		b. To take responsibility for one's own problems.	13. 14	15. 16	4
3	Reach (R) This dimension is part of adversity intelligence, which asks how far the difficulties faced will affect other aspects of an individual's life.	a. Capable of minimizing the effects of problems.	18. 19. 20. 21	22	5
		b. Capable of dealing with numerous challenges effectively.	23. 24. 25. 26	27. 29. 30	7
4	*Endurance* (E) This dimension can be interpreted	a. Developing an optimistic attitude from difficulties.	31. 32. 33. 34. 35. 36	28. 37. 38	10

as resilience, which involves two related aspects: the duration of the difficulty and the individual's response to the time it takes to solve the problem.	b. Having faith that the problem will not last long.	39. 40	41. 42	4

conduct validity and reliability tests. Based on the validity test data, one questionnaire item was discarded because the calculated r-value (r = 0.22759) was less than the table r-value (r = 0.296). Meanwhile, the reliability test results yielded an r11 value of 0.8896, which is greater than 0.8, indicating that all test items consistently have strong reliability. After several tests, it was found that the questionnaire consisted of 42 items.

The test used was an essay test with PISA-oriented questions developed by the researcher. The test consisted of one question designed based on the horizontal mathematization process indicators. The framework for the horizontal mathematization process is presented in Table 4.

To ensure that the test instrument to be used is suitable for the research and can measure

Table 4. The horizontal mathematization process framework

Content Aspects	Context Aspects	Competency Aspects	Mathematics Ability Level	Measured Horizontal Mathematization Process Indicators	Question Indicator	Question Item Number
Quantity: Students will develop an understanding of magnitude, numerical patterns, and the application of numbers in real-world contexts.	General: Students can contribute their understanding of mathematical knowledge and concepts to evaluate various relevant societal situations.	Reflection: Students can identify the mathematical ideas behind unstructured problems.	6	a. Students can identify the mathematical concepts related to contextual problems they encounter. b. Students can correlate problems with mathematical language (symbols, tables, graphs, diagrams, etc.). c. Students can create mathematical models.	Given a PISA-oriented contextual problem related to number patterns concerning the area of a circle (grinding wheel), students can visualize the problem in the form of a picture and students can model the problem mathematically.	1

students' mathematical processes, it is necessary to validate the test instrument with validators who are experts in the relevant test material. Validation is carried out by mathematics lecturers and mathematics teachers. A PISA-oriented test is presented in Figure 1.

The interview guide contains focused questions to explore the research subject's mathematical modeling process when solving PISA-oriented problems that are not apparent on the answer sheet and to strengthen the opinions given on the answer sheet. The developed instrument was then validated by designated validators, namely individuals considered experts and competent in the field of mathematics. The validation of the interview guide was based on the suitability of the material, construction, and language appropriateness.

Data Collection Method

The required data was collected directly by the researcher. The data collection methods used

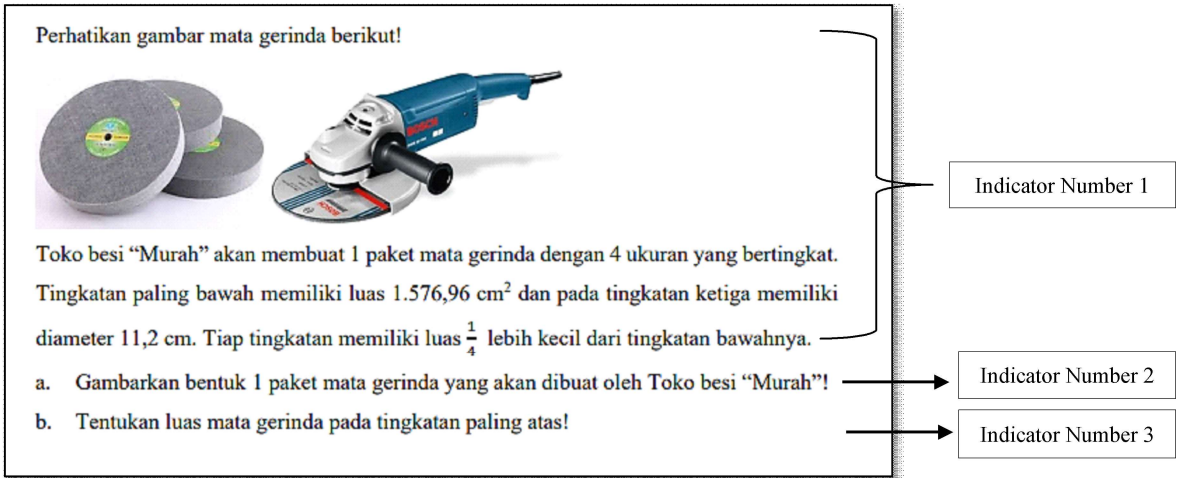

Figure 1. Test instruments

in this research were questionnaires, tests, and interviews. Subjects completed the AQ questionnaire to be categorized based on the AQ type: climber, camper, and quitter. Subsequently, the subjects took a mathematical modeling test to solve PISA-oriented problems. Then, based on the research subject selection criteria, several research subjects with good communication skills were selected based on information from the mathematics teacher. In the next stage, the research subjects were interviewed. Furthermore, the interview data,supported by the subjects' written answers, was analyzed and compared.

Data Validity

The data obtained by the researcher based on field activities is processed for accuracy and needs to be validated. This is necessary to avoid any information deviation from processing the obtained data. The researcher chooses the appropriate way to develop the validity of the obtained data. The data validity used in this research is the triangulation technique. Method triangulation is the triangulation that will be used in this research.

The intended method of triangulation compares the results of students' work on written tests with the results of student interviews. Data is collected using two different approaches in a sequential manner, namely the test method and the interview method. The data from students' work that has been obtained is used as a reference for conducting interviews. Furthermore, the data from students' work is compared with the interview data. Data or findings are considered valid if the students' work is consistent with the interview results and vice versa. Interviews in this research also aim to explore information not appearing on the students' work sheets. The researcher collects data students' mathematical processes through written tests and interviews.

Data Analysis

According to Mezmir (2020:17), the data analysis process consists of four stages: familiarization, data reduction, data display, and report writing. The initial stage before analyzing data is to become more familiar with the existing data. At this stage, researchers need to detail the data from questionnaires, tests, and interviews to understand its diversity and complexity. During the data review process, researchers are advised to make detailed notes. These notes include various participant responses to the questions asked and recurring themes or important issues that arise in the data.

Qualitative research often produces a vast amount of data. This large amount of data certainly

requires extra effort to manage. Therefore, the data reduction process is crucial to simplify the data and focus on the most relevant information. The data we collected focused on the parts where research subjects carried out horizontal mathematization processes. The analysis did not include Parts that were irrelevant to horizontal mathematization processes. After conducting the interviews, we replayed the recordings, transcribed the conversations fully, selected the important parts, and reviewed the transcripts to ensure accuracy.

The data that has been simplified is then presented in a structured narrative form. This presentation aims to make the data easier to see, understand, and analyze. After that, each part of the data will be examined in depth to identify the horizontal mathematization processes carried out by students, referring to the predetermined indicators of horizontal mathematization processes. The researcher analyzes how students with AQ climber, camper, and quitter types solve PISA-oriented problems. This analysis aims to describe the differences and similarities in the horizontal mathematization processes carried out by each type of student.

The final step in this analysis is to interpret the presented data. We will try to identify patterns, concepts, and theories from the data to build a deeper understanding of the phenomenon we are studying. The conclusion of this study is to understand the students' mathematization processes in solving PISA-oriented problems from various types of AQ students.

■ RESULT AND DISCUSSION

The researcher describes research subjects with a climber AQ type while solving PISA-oriented problems. The author describes the data from one subject in each AQ type, detailing the mathematization process when solving PISA-oriented problems. The data presented for each subject represents the entire dataset for each AQ type. Subject 1 (S-1) is a subject with a climber AQ type, subject 2 (S-2) is a subject with a camper AQ type, and subject 3 (S-3) is a subject with a quitter AQ type. The data presented for each subject represents all data within the climber AQ type. The data analysis of research subjects follows the indicators of horizontal mathematical modeling.

S-1: Subject with Climber AQ Type

At the first stage of the horizontal mathematization process, S-1 was able to write down what was known after reading the problem, as shown in Figure 2. Excerpt from the interview with S-1:

Interviewer: *"Can you tell me what concept was used to solve this problem?"*
S-1: *"In this problem, the concept of the area of a circle was used to solve the problem."*
Interviewer: *"How did you know that the concept of the area of a circle was used?"*
S-1: *"I can say that this problem can be solved using the concept of the area of a circle because the problem was about a circular grinding wheel, and the problem also mentioned the area of the grinding wheel at the lowest level. The area of the circular grinding wheel at the highest level was also asked in this problem."*

Based on the interview excerpt above, S-1 explained that the concept used to solve the problem was the area of a circle. S-1 was able to explain in great detail why they thought the concept of the area of a circle was used. Thus, it can be said that the subject could identify the mathematical concept related to the contextual problem they were facing.

At the second stage of the horizontal mathematization process, S-1 wrote the symbol L for area and d for diameter. In Figure 2, it can

be seen that the subject depicted one package of drill bits, which is four circles of different sizes. The largest circle is the first level and will become smaller at the next level. Thus, it can be said that the S-1 was able to correlate the problem with mathematical language (symbols, tables, graphs, images, etc.).

At the third stage of the horizontal mathematization process, S-1 wrote $LT_2 = ¼ \times LT_1$. After the interview, it was understood that LT_2 refers to the area of the second level of drill bits, and LT_1 refers to the area of the first level of drill bits. The mathematical model written by S-1 was obtained from the problem, which stated that "Each level has a smaller area than the level below it." Thus, it can be said that the S- was able to create a mathematical model.

Climbers are always eager to take on new challenges and are persistent in overcoming obstacles. They quickly grasp new mathematical concepts and demonstrate flexibility in applying mathematical symbols. They are also highly creative problem solvers. The successful application of horizontal mathematization by Climber students suggests a strong foundation for vertical mathematization. Their enjoyment of challenges further supports their ability to explore diverse problem-solving approaches within the mathematical domain.

The higher the adversity quotient category, the higher the students' ability in mathematics learning (Dewi & Wutsqa, 2024: 637). The results of S-1's work show that S-1 has a high ability in mathematics learning. The interview results with S-1 show that S-1 confidently and enthusiastically solved the PISA problem. Students with a climber AQ type will have a high fighting spirit in solving problems and motivation in learning so that student outcomes will improve (Rokayah et al., 2023: 979).

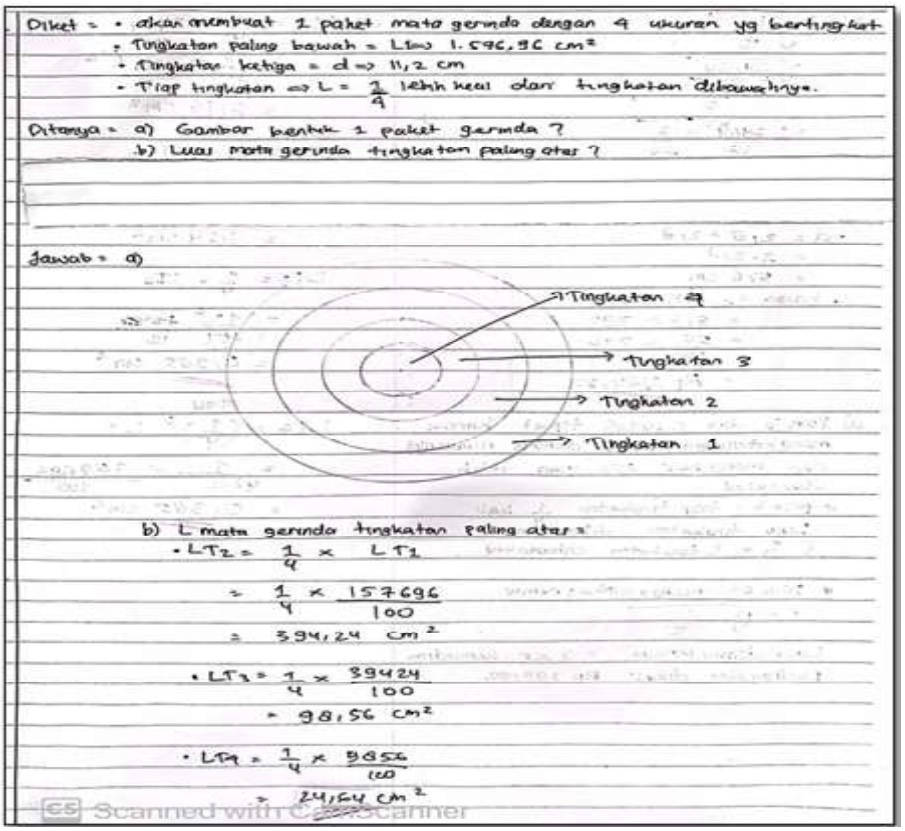

Figure 2. Subject with climber AQ type

S-2: Subject with Camper AQ Type

In the first stage of the horizontal mathematization process, S-2 was able to write down what was given in the problem, as shown in Figure 3. Excerpt from the interview with S-2:

Interviewer: *"What concept did you use to solve this problem?"*
S-2: *"The concept used in this problem is the area of a circle."*
Interviewer: *"How did you know that the concept of a circle was used?"*
S-2: *"Because there was a picture of a circular grinding wheel in the problem."*

Based on the interview excerpt above, S-2 explained that the concept used to solve the problem was the circle. S-2 explained their reasoning for choosing this concept briefly. Thus, it can be said that the subject was able to identify the mathematical concept related to the contextual problem they were facing.

In the second stage of the horizontal mathematization process, S-2 wrote the symbols T2 for the second level, T3 for the third level, and T4 for the fourth level. S-2 did not write other symbols such as L, d, etc. In Figure 3, it can be seen that S-2 drew 1 set of gears, which are four circles of different sizes. The largest circle is the first level and gets smaller at the next level. Therefore, it can be said that S-2 could correlate the problem with mathematical language (symbols, tables, graphs, diagrams, etc.) but was not complete.

In the third stage of the horizontal mathematization process, S-2 wrote T2 = 1576.96 x ¼. After an interview, the 1576.96 written by S-2 was the area of the smallest gear. S-2 also wrote T3 = 394.24 x ¼ and T4 = 98.56 x ¼, where 394.24 was obtained from the area of the second-level gear obtained from the mathematical model T2 = 1576.96 x ¼ and 98.56 was obtained from the area of the third-level gear obtained from the mathematical model T3 = 394.24 x ¼. The mathematical model written by S-2 was obtained from the problem stating, "Each level has an area smaller than the level below it". Therefore, it can be said that the subject could create a mathematical model but did not write the mathematical model with complete symbols.

Individuals with a Camper AQ profile exhibit initial motivation but often succumb to challenges and seek external support. While capable of comprehending fundamental concepts, they struggle to establish connections between these and more intricate ideas. Additionally, they frequently encounter difficulties in selecting appropriate mathematical symbols and require guidance in constructing mathematical models. Based on the findings, Camper students encounter difficulties in the horizontal mathematization process. While they may be proficient in calculations, they struggle to interpret results and connect them back to the real-world context during the vertical mathematization phase.

S-2's behavior reflects the typical characteristics of a Camper. Their reluctance to delve deeper into information due to fear and comfort leads them to have limited capacity for significant change. The interview with S-2 showed that they did not seek out more information when they did not understand the question, and they did not complete the task seriously. S-2 did not double-check their answers, assuming the task was complete and submitted. As explained by Septyaningtyas and Jusra (2020: 665), Campers often exhibit a tendency to avoid difficulties, feel uncomfortable with uncertainty, and prefer more straightforward solutions, even if they are less optimal.

S-3: Subject with Quitter AQ Type

In the first stage of the horizontal mathematization process, S-3 was able to write down the information given by the problem, as shown in Figure 4. Excerpt from the interview with S-3:

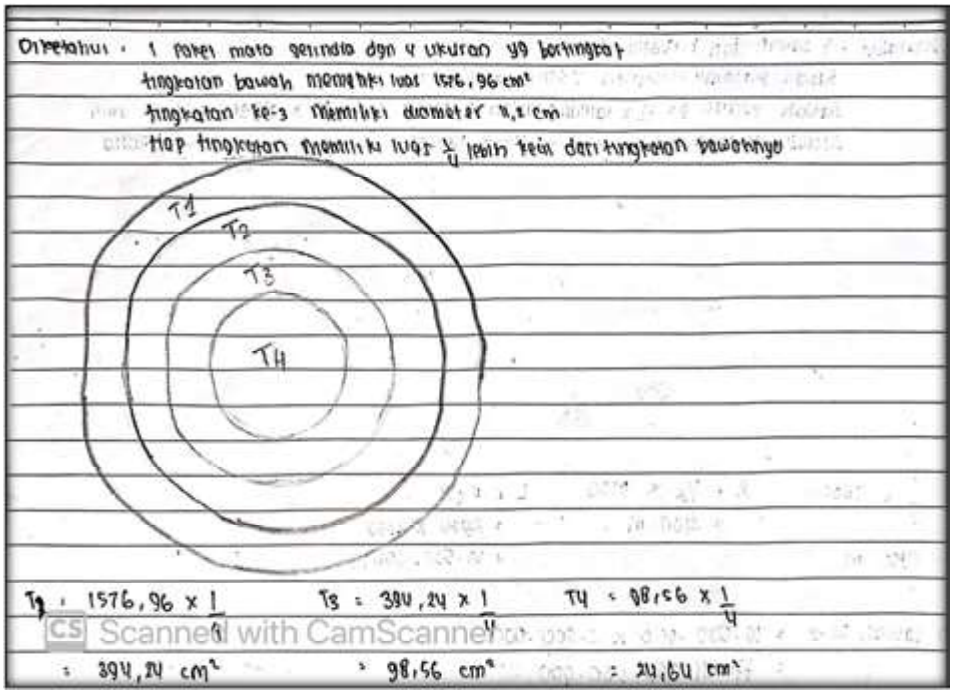

Figure 3. Subject with camper AQ type

Interviewer: *"Do you know what concept is used to solve this problem?"*

S-3: *"Mmm... I think the concept used is a circle."*

Interviewer: *"Why do you say that?"*

S-3: *"I'm not sure, but I think it's because there's a picture of a circular grinding wheel."*

After the interview, the subject explained that the concept used was a circle. S-3 could say this because there was a picture of a circular grinding wheel in the problem. Although S-3 seemed hesitant, their answer about the circle concept was correct. This indicates that the subject was able to identify the relevant mathematical concept for the given contextual problem.

In the second stage of the horizontal mathematization process, S-3 wrote down the given information without using symbols. Figure 4 shows that S-3 drew one package of grinding wheels, which consisted of 4 circles of different sizes. The smallest circle represented the first level, and it became larger in the subsequent levels. However, S-3 made a mistake in drawing one package of gears, as the largest circle should have been the first level, and it should have become smaller in the subsequent levels. Therefore, it can be said that S-3 was unable to correlate the problem with mathematical language (symbols, tables, graphs, diagrams, etc.).

In the third stage of the horizontal mathematization process, S-3 wrote T3 = 1576.96 x ¼. After an interview, it was revealed that 1576.96, written by S-3, was the area of the fourth-level gear. S-3 also wrote T3 = 394.24 x ¼ and T1 = 98.56 x ¼, where 394.24 was obtained from the area of the third-level gear, which was calculated using the mathematical model T3 = 1576.96 x ¼, and 98.56 was obtained from the area of the second-level gear, which was calculated using the mathematical model T3 = 394.24 x ¼. The mathematical model written by S-3 was derived from the diagram that

S-3 had created. However, this result was incorrect because S-3 made a mistake in drawing one package of gears. Therefore, it can be said that the subject was unable to create a mathematical model.

Students with a Quitter AQ type exhibit low motivation and avoid challenging tasks, often seeking excuses to avoid completing assignments. Quitters struggle to comprehend abstract concepts and prefer explicit procedures. They frequently make errors when using symbols, especially in unfamiliar situations, and often feel incapable of constructing mathematical models. Quitter students tend to avoid the horizontal mathematization process. They struggle to comprehend problems and feel incapable of constructing models. If forced to perform calculations, they may make numerous errors. As a result, the vertical mathematization process of Quitter students is likely to be incomplete.

A student's success in facing and solving a problem cannot be separated from a high adversity quotient (AQ) (Akbar et al., 2023: 125). On the other hand, a low adversity quotient will reduce a student's success in solving PISA-oriented problems. This is in line with the results of S-3's work, which showed that S-3 could not solve the PISA-oriented problem correctly. After an interview, it was found that this quitter-type AQ had a low desire to succeed, avoided problems that they considered problematic, and refused to try challenging things, so quitters would work as hard as they could and give up as soon as thei realized they were doing something wrong.

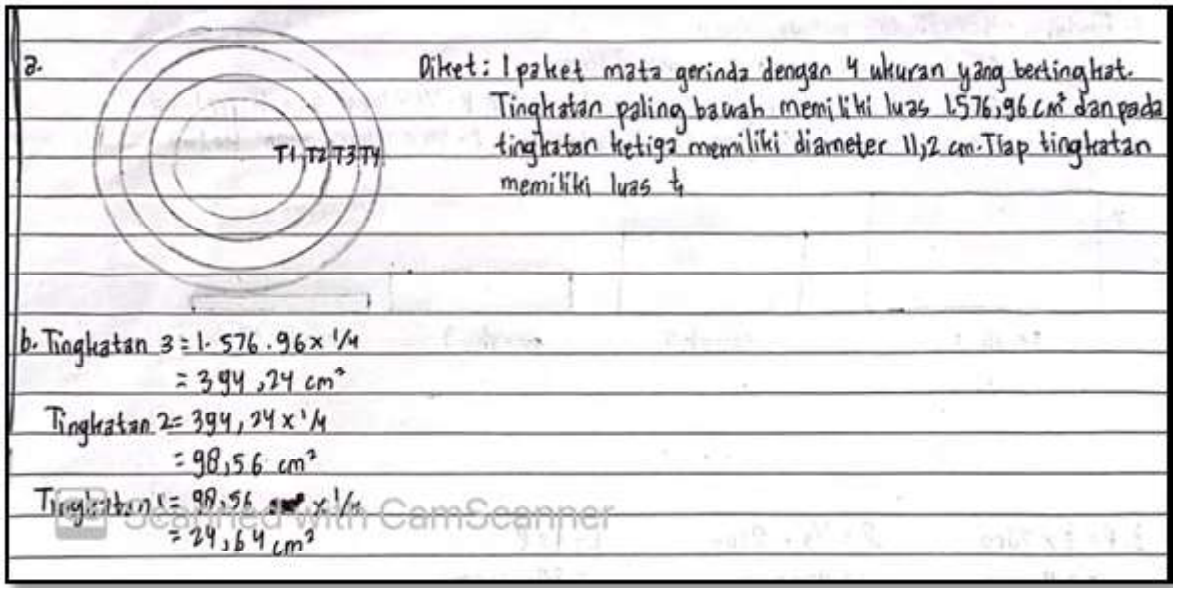

Figure 4. Subject with quitter AQ type

Based on this research, students with a climber AQ type have a better or higher level of mathematical process than those with a camper or quitter AQ type. Students with a climber AQ type can solve problems with enthusiasm and perseverance, always striving to find a solution (Asni et al., 2021: 75). Students with a camper AQ type tend to be enthusiastic and willing to try but easily get satisfied. Meanwhile, students with a quitter AQ type are unable to solve problems effectively because they tend to give up when faced with difficulties.

Table 5. Differences in horizontal mathematical thinking based on AQ type

Indicators	AQ Type		
	Climber	Camper	Quitter
1. Students can identify mathematical concepts related to their contextual problems.	√	√	√
2. Students can correlate problems with mathematical language (symbols, tables, graphs, images, etc.).	√	√	—
3. Students can create mathematical models.	√	√	—

Students have the ability to transform the difficulties they face into new challenges that must be overcome, a characteristic known as the adversity quotient (Veola & Faiziyah, 2023: 6772-6773). The higher a person's ability to cope with difficulties (adversity quotient), the lower their perceived stress levels during learning (Aaung & San, 2020: 656). While most people tend to avoid difficulties, adversity quotient positions these challenges as opportunities for personal growth (Djunaidah et al., 2023: 7). Students with the highest AQ type, 'climbers,' exhibit strong vertical mathematization processes when facing PISA-oriented problem-solving challenges. Conversely, students with the lowest AQ type, 'quitters,' demonstrate weaker vertical mathematization processes. The adversity quotient is a crucial variable to study as it can contribute to a successful life (Anju & Sahoo, 2023: 30).

Knowing a student's AQ type is important in Indonesian education. AQ can serve as a foundation for developing critical thinking skills in problem-solving within the Merdeka Curriculum currently implemented in Indonesia. The AQ students possess becomes an important ability as in-depth analysis of information is essential to solve problems related to daily life. The era of globalization also demands individuals to have critical and analytical thinking skills to face complex challenges. Therefore, students are required to have high AQ to improve the quality of Indonesian education on the international stage.

Teachers can employ various methods to ascertain students' AQ types. Observation can be utilized to assess students' behavior when confronted with challenges and to evaluate their responses to feedback. Furthermore, teachers can administer validated and reliable questionnaires to identify students' AQ. Individual interviews with open-ended questions can also be conducted to determine students' AQ type.

Teachers can implement different approaches based on students' AQ types to optimize learning. Climber students who enjoy challenges can be given complex tasks and creative projects. Meanwhile, Camper students, who tend to give up easily, need emotional support, smaller task breakdowns, and positive feedback. As for Quitter students, who often avoid difficulties, they should start with easier tasks to build their self-confidence.

■ CONCLUSION

Subjects with a climber AQ type have high self-belief and are persistent in solving PISA-oriented problems, enabling them to perform all indicators of the horizontal mathematization process well. They can effectively identify relevant mathematical concepts in contextual problems, correlate these problems with mathematical language (symbols, tables, graphs, diagrams, etc.), and accurately construct mathematical models.

Subjects with a camper AQ type have a moderate level of self-belief and persistence in solving PISA-oriented problems. Although they may experience confusion, they still strive to solve the problems and can adequately perform most horizontal mathematics process indicators. They can correctly identify relevant mathematical concepts but may have some difficulties in

correlating the problem with mathematical language and constructing a complete mathematical model.

Subjects with a quitter AQ type have low self-belief and tend to give up easily when faced with PISA-oriented problems, even when experiencing confusion. Consequently, they cannot perform all indicators of the horizontal mathematization process well. They can correctly identify relevant mathematical concepts but struggle to correlate the problem with mathematical language and construct an accurate mathematical model.

Teachers can use this research as additional information to find effective and efficient learning models by considering students' internal factors, one of which is the Adversity Quotient (AQ) and the students' mathematization process. Since Indonesia ranks low in international assessments like PISA, teachers can provide contextualized learning materials and non-routine mathematical problems. These mathematical problems can be oriented towards PISA-style questions. This approach can foster students' self-confidence and abilities.

Limitations such as a small sample size or a focus on a single school can restrict the generalizability of research findings. Conducting research in only one school limits the representation of population variability. Therefore, the results of this study can only be generalized to schools with highly similar characteristics. By understanding the implications of these limitations, researchers can take steps to minimize bias and enhance research quality.

To enhance the generalizability of the findings, further research involving a more heterogeneous sample, including students from diverse cultural backgrounds and schools with varying levels of resources, is recommended. Additionally, teacher training can be a strategic step to improve their ability to identify students' AQ types and design instruction tailored to the individual needs of each student, especially for Quitter-type students who need to be encouraged to develop their coping skills.

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