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Analysis of Students' Mathematical Creative Thinking Abilities Viewed from Adversity Quotient

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Abstract

Creative mathematical thinking is the ability that encourages students to discover various solutions for solving math problems, yet its development requires resilience, known as the Adversity Quotient (AQ), categorized into quitter, camper, and climber. The purpose of this study is to describe students' mathematical creative thinking abilities in terms of the Adversity Quotient, specifically among students who participate in Creative Problem Solving lessons. This study employs a qualitative approach and is a descriptive study. Data analysis in this study encompassed data reduction, data presentation, and drawing conclusions. The results of this study show that climber students have varying levels of achievement. Although some subjects were able to meet all indicators—namely, fluency, flexibility, originality, and elaboration—some students did not yet meet certain indicators, such as flexibility. Camper students met the fluency indicator. No quitter students were identified in this study. The Adversity Quotient plays a significant role in the development of students' mathematical creative thinking skills. The higher a student's resilience in facing difficulties, the greater their ability to find various solutions.

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INTRODUCTION

Mathematical creative thinking is one of the higher-order thinking skills. It encourages students to discover diverse solutions or ideas when solving mathematical problems (Komarudin et al., 2021; Ridho Saputra et al., 2024; Susilawati et al., 2025). In mathematics education, it refers to students' ability to solve a mathematical problem by generating varied, novel, and unique solutions. This aligns with Sari et al. (2022), who view it as a cognitive ability that leads to new ideas, perspectives, approaches, and methods for understanding concepts. Setiyani (2020) adds that it is a thinking habit that can be cultivated by paying attention to intuition, stimulating imagination, exploring new possibilities, uncovering fascinating perspectives, and discovering unexpected ideas.

According to Munandar (Rahmawati et al., 2023) there are four indicators of creative mathematical thinking, namely: (1) fluency, the ability to solve mathematical problems accurately and smoothly; (2) flexibility, which is students' ability to use a variety of strategies to solve mathematical problems; (3) originality, the ability to solve problems in unique ways; and (4) elaboration, the ability to expand upon solutions to problems.

Although the ability to think creatively in mathematics is very important, the reality is that students in Indonesia have not yet mastered this skill. According to the 2015 Global Creativity Index (GCI) report—which measures creativity through the aspects of technology, talent, and tolerance—Indonesia ranked 115th out of 139 countries with a score of 0.202, far below the global average (Agoestanto & Masitoh, 2021). Although the GCI measures creativity in general, Indonesia's low score also reflects challenges in fostering creativity across various fields, including creative thinking in the context of mathematics education. Given this low ranking, the government, society, and educators must pay special attention to developing students' creative potential (Aida, 2024; Nasution et al., 2024; Pujiastuti et al., 2021).

When solving math problems, students face the challenge of finding solutions to these problems—a challenge known as the Adversity Quotient (AQ). The Adversity Quotient transforms obstacles or difficulties into opportunities for success in achieving goals. Stoltz (2000) divides AQ into three categories: climbers, campers, and quitters. A quitter is someone who gives up easily before even trying, while a camper still has the desire to try but eventually gives up at a certain point because they feel they've reached a safe point. Finally, a climber is someone who doesn't give up easily when facing challenges. In fact, climbers view challenges as opportunities. AQ plays an important role in a person's life (Paramita et al., 2022; Syarifah & Agoestanto, 2024).

According to Stoltz, students who cannot think creatively are unable to persevere in the face of difficulties. This aligns with research conducted by Asmaun (2024), which found that when asked to solve problems, students still struggled because they were fixated on the solution methods taught by their teachers. The study shows that students lack alternative solutions for solving math problems, which, among other factors, depends on their level of resilience in facing problems. Therefore, creative thinking can be linked to the Adversity Quotient (Ramdanti & Ismi, 2021; Syarifah & Agoestanto, 2023).

In the teaching-learning process, to develop students' creative mathematical thinking skills, teachers must employ various strategies so that students can achieve the expected learning outcomes effectively and efficiently. One such strategy is implementing the Creative Problem Solving (CPS) learning model (Aziz & Prasetia, 2021; R. M. V. N. Sari et al., 2021). Through Creative Problem Solving, students can solve problems in various ways. CPS is an ideal approach for students to enhance their effectiveness and independence and to overcome the complex challenges they face. CPS is a learning model that employs a systematic problem-solving process, enabling students to solve problems by generating creative ideas based

on the challenges they encounter (Agustina et al., 2023; Panuntun Hsm et al., 2021).

The CPS model was used in this study because it systematically fosters creative thinking, helping students not only find solutions but also understand the underlying thought processes. CPS provides a framework that guides students through stages that allow them to develop mathematical creative thinking skills in problem-solving, resulting in more in-depth and structured outcomes. Research by Rahmawati et al. (2023) shows that the CPS model is effective in improving mathematical creative thinking skills because it encourages students to think critically, flexibly, and boldly try new ideas.

Given the importance of creative mathematical thinking skills in mathematics education and the differences in how each student copes with the challenges they face, this study is expected to contribute to educators' practice. The purpose of this study is to describe students' creative mathematical thinking skills as measured by the Adversity Quotient.

METHOD

This study is a descriptive study that uses a qualitative approach to describe students' mathematical creative thinking abilities as viewed through the Adversity Quotient (AQ) in the Creative Problem Solving (CPS) learning model. Quantitative data were obtained from the results of tests measuring students' mathematical creative thinking abilities, while qualitative data were obtained from interviews with research subjects selected based on AQ categories. This study was conducted at SMP Takhassus Al-Qur'an Al-Huda Batang from May to June 2025. The research subjects were eighth-grade students in the 2024–2025 school year.

Before the study was conducted, the research instruments and instructional materials were first validated by expert validators. Next came the instructional implementation phase. Students were taught the Pythagorean Theorem using the CPS instructional model. During the lesson, teaching activities were observed by fellow teachers using a teacher activity observation sheet, and at the end of the lesson, students completed a student response sheet. Then, at the end of the session, students were given a posttest on mathematical creative thinking skills (KBKM). This KBKM test consisted of four essay questions that measured four indicators of mathematical creative thinking skills: fluency, flexibility, originality, and elaboration.

After that, the students were given the ARP (Adversity Response Profile) questionnaire to determine their AQ category. This questionnaire was adapted from the study by Wahyuningtyas et al. (2020). After the students completed the questionnaire, the researcher selected several students to be interviewed regarding their mathematical creative thinking abilities. The interviews were conducted based on interview guidelines previously developed by the researcher. Research subjects were selected using a purposive sampling technique, that is, based on specific considerations according to their AQ category.

The research data were analyzed through data reduction, which involved discarding unused data and selecting key data for the study, such as students' mathematical creative thinking test answer sheets, AQ questionnaire results, and interview data from the research subjects. Subsequently, the selected data from the data reduction stage were presented, and conclusions were drawn.

RESULTS AND DISCUSSIONS

This section describes students' mathematical creative thinking abilities as measured by the Adversity Quotient in Creative Problem Solving. The results are as follows.

Adversity Quotient (AQ)

Stoltz (2000) defines the Adversity Quotient as a person's ability to analyze difficulties and transform them into opportunities, thereby turning them into challenges to be overcome. The Adversity Quotient is essential when facing difficulties—in this case, when students are solving math problems. There are three categories of Adversity

Quotient: climber, camper, and quitter. The following are the results of the students' ARP questionnaire.

Table 1. Student ARP Survey Results

No.	Category	Number of Students	Persentage
1.	*Climber*	5	21,7%
2.	*Camper*	18	78,3%
3.	*Quitter*	0	0%
	Total	23	100%

In this study, there were only two categories: climber and camper; no quitter category was identified. Research subjects were selected using a purposive technique, based on specific criteria in accordance with the AQ categories. All students in the climber category—5 students in total—were selected. For the camper category, 5 students who were close to the category average were selected.

Students' Creative Mathematical Thinking Ability

In this study, students' mathematical creative thinking skills were assessed using a written test consisting of open-ended questions designed to measure four indicators of mathematical creative thinking: fluency, flexibility, originality, and elaboration.

The results of the students' mathematical creative thinking skills test are as follows.

Table 2. Student Test Results

No.	Category	Number of Students	Persentage
1.	High	5	21,74%
2.	Middle	14	60,87%
3.	Low	4	17,39%
	Total	23	100%

Discussions

This section describes students' mathematical creative thinking abilities as assessed by AQ in the CPS learning model. The indicators used are fluency, flexibility, originality, and elaboration, as proposed by Munandar (2016). Learning activities were conducted over three sessions. After the CPS sessions and the final test of mathematical creative thinking skills were completed, the researcher interviewed 5 climber students and 5 camper students. The following are the results of the analysis of students' mathematical creative thinking skills based on the two AQ categories: climber and camper.

Creative Mathematical Thinking Abilities of Climber Type Students

Subjects S1, S2, S3, S4, and S5 are students categorized as AQ Climbers. Although they are all Climbers, several differences in characteristics were found in their performance on the creative mathematical thinking test. This study identified three distinct Climber profiles: a group of subjects who met all indicators (S1 and S3), a group of subjects who did not meet the flexibility indicator (S4 and S5), and a subject who did not meet the flexibility and elaboration indicators (S2).

An analysis of the test performance of the first group—S1 and S3—is presented in detail as follows.

Subjects S1 and S3

Subjects S1 and S3 were able to complete the mathematical creative thinking test. Both subjects met all the indicators of mathematical creative thinking: fluency, flexibility, originality, and elaboration. The following are the work samples from subjects S1 and S3 for question 1.

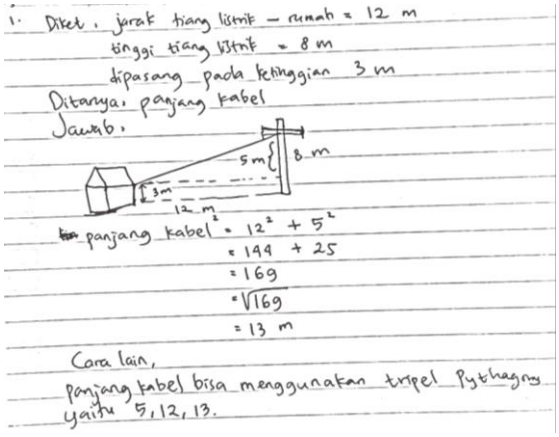

Figure 1. Test Results for Subject S1, Question No. 1

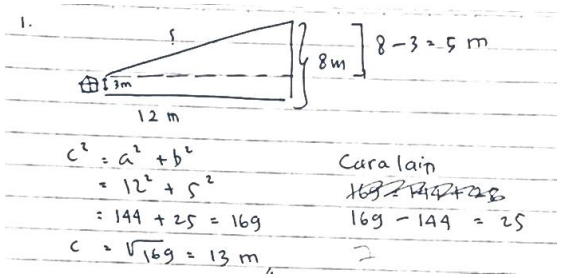

Figure 2. Test Results for Subject S3, Question No. 1

Based on Subject S1's work in Figure 1, Subject S1 demonstrated good fulfillment of the fluency indicator, as the subject wrote down the information, labeled it in the diagram, and calculated the answer accurately and fluently. Furthermore, the subject also tried another method for calculating the cable length, namely using the Pythagorean Triple. This indicates that Subject S1 met the flexibility indicator.

Subject S1's demonstration of the originality indicator was quite good, as the subject determined the height of 5 m without performing any calculations but instead wrote it directly on the drawing. Furthermore, the subject demonstrated good fulfillment of the elaboration indicator by presenting neat and detailed calculations.

Next, Subject S3's work is shown in Figure 2. Subject S3 exhibits characteristics similar to Subject S1, namely meeting all four indicators: fluency, flexibility, originality, and elaboration. There is a difference between Subjects S1 and S3. Subject S1 exhibited a more procedural approach to the task compared to Subject S3. This is evidenced by Subject S1's response, which was written in a sequential manner—starting from what was known, moving to the question, and ending with the answer—while Subject S3 proceeded directly to calculating the answer.

This is consistent with the research by Sari et al. (2022), which found that subjects with a climber AQ category exhibit a high level of determination when facing problems or obstacles. Consequently, students with a climber AQ perform well on tasks assessing creative mathematical thinking (Manazila et al., 2022; Widiyanto et al., 2021).

Next, the analysis of the performance of the second group—S4 and S5—is presented in detail as follows.

Subjects S4 and S5

Subjects S4 and S5 were able to complete the mathematical creative thinking test questions. Both subjects met the indicators of mathematical creative thinking, namely fluency, originality, and elaboration. The following are the results of Subjects S4 and S5's work on question 2.

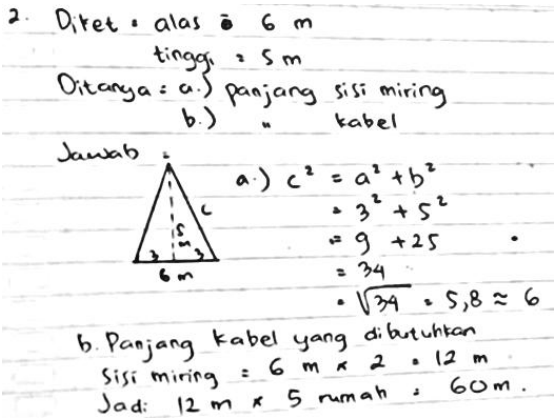

Figure 3. Test Results for Subject S4, Question No. 2

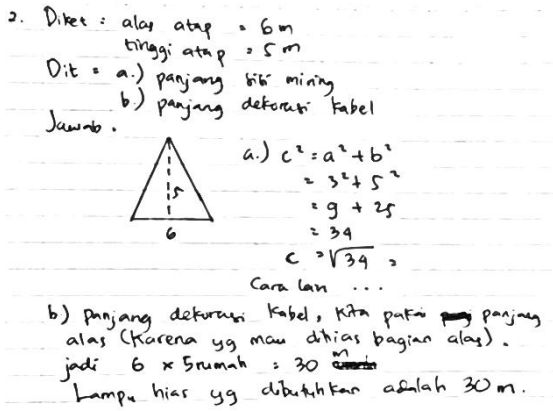

Figure 4. Test Results for Subject S5, Question No. 2

Based on Subject S4's performance on the task shown in Figure 3, Subject S4 demonstrated good fulfillment of the fluency indicator, as the subject wrote down the information, labeled the figures, and calculated the answers accurately and fluently. On this task, the subject used only one problem-solving strategy without attempting any other approaches. This indicates that the flexibility criterion was not met.

Subject S4 demonstrated a fairly good level of originality. The subject calculated the length of the string lights based on the previously determined length of the sloping side, which was 6 m. Thus, 6 multiplied by the 2 sides of the roof equals 12 m. Then, 12 × 5 houses = 60 m. The subject demonstrated a good level of elaboration by presenting neat and detailed calculations.

Next, Subject S5's work is shown in Figure 4. Subject S5 exhibits characteristics similar to Subject S4, namely meeting the indicators of fluency, originality, and elaboration. There is a difference between Subjects S4 and S5 regarding the strategy used to determine the length of the decorative cable in part (b). This is evidenced by Subject S4's answer, which used the base length of the triangle as a reference to calculate the length of the decorative cable, while Subject S5 used the lengths of the triangle's two sloping sides.

This aligns with the research by Hifyatin et al. and Azmi et al. (2025; 2022). This is due to the low AQ indicator, specifically in the endurance dimension, which caused students not to propose alternative methods because they found it difficult to come up with new ideas.

Next, the analysis of the third group's work—Group S2—is presented in detail as follows.

Subject S2

Subject S2 was able to complete the mathematical creative thinking test questions quite well. The subject met the indicators of mathematical creative thinking, namely fluency and originality. The following are the results of Subject S2's work on question 2.

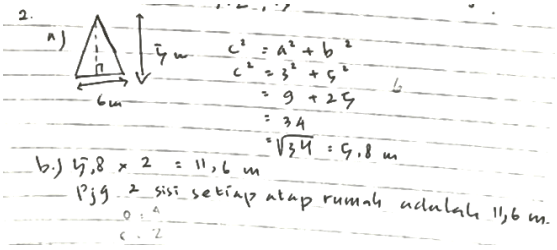

Figure 5. Test Results for Subject S2, Question No. 2

Based on the results of the S-2 subject's work in Figure 5, part (a), the student immediately drew the figure and then calculated the length of the hypotenuse using the Pythagorean Theorem, arriving at the correct answer. Thus, the student met the fluency indicator. In this problem, the student used only one problem-solving strategy without attempting any other approaches. This indicates that the flexibility indicator was not met.

In part (b), the subject provided a unique answer, but the work process was not perfect; thus, the subject sufficiently met the originality indicator. Regarding the elaboration indicator, the subject wrote out an answer, but there were errors because the answer was not fully completed and the explanation lacked detail. Therefore, the subject did not meet the elaboration indicator.

Creative Mathematical Thinking Abilities of Camper Type Students

Subjects S6, S7, S8, S9, and S10 are students in the camper category. All five subjects share similar characteristics in terms of mathematical creative thinking ability, specifically meeting only the fluency indicator. The following are the results of the work submitted by subjects S6, S7, S8, S9, and S10 for question 3.

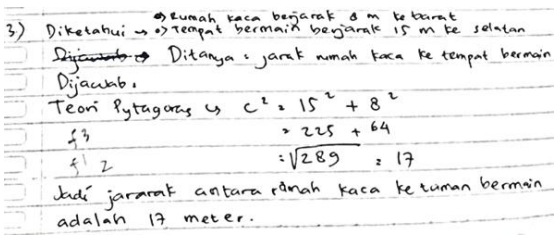

Figure 6. Test Results for Subject S6, Question No. 3

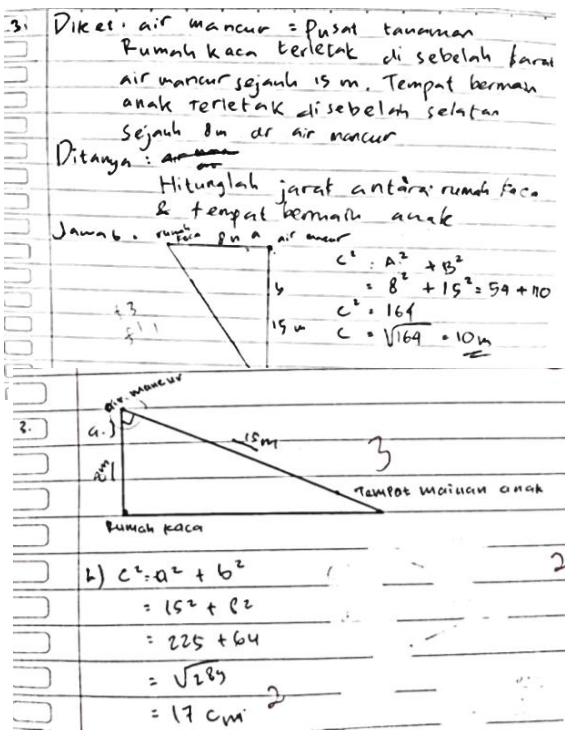

Figure 8. Test Results for Subject S8, Question No. 3

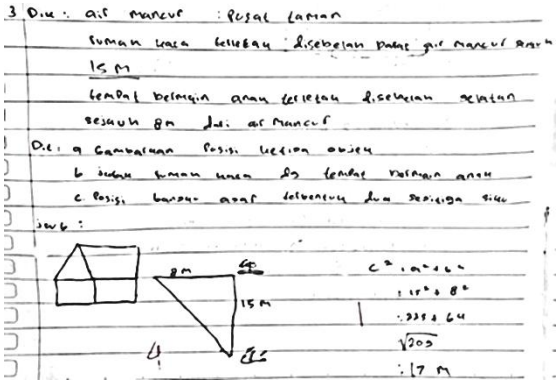

Figure 9. Test Results for Subject S9, Question No. 3

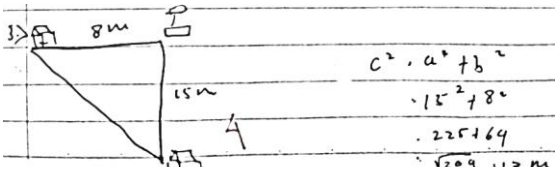

Figure 10. Test Results for Subject S10, Question No. 3

Based on Figure 6, subject S6's work demonstrates good fulfillment of the fluency indicator through smooth writing of the initial information and accurate completion of the Pythagorean Theorem calculation. However, subject S6 did not meet the flexibility indicator because they relied on only one strategy; did not meet the originality indicator because the method used was conventional; and did not demonstrate mastery of elaboration due to a lack of detailed explanation.

Similar characteristics were also exhibited by subjects S7 through S10 in Figures 7 through 10, where their performance was generally limited to meeting the fluency indicator, with some variations in the details of their work as follows.

- ***Subjects S7 and S9***

  Both of these subjects followed a problem-solving pattern similar to that of Subject S6. The difference is that Subject S7 made a calculation error, resulting in an incorrect final answer, while Subject S9 successfully completed the calculation with the correct final result.
- ***Subjects S8 and S10***

  Both subjects chose to focus directly on calculating using the formula after sketching the triangle. The difference lies in the level of detail in their writing, where the contextual explanation provided by subject S10 was much briefer than that of subject S8.

Thus, although the camper group of subjects had the same AQ, they exhibited different characteristics when working on the mathematical creative thinking test questions.

This is consistent with the research by Maftuha et al. (2025), which found a similar pattern: subjects with a Camper AQ only met the fluency indicator. Based on the research by Widiyanto et al. (2021), students in the Camper category are already satisfied with the results they achieve. Consequently, students of the camper type rely solely on their current abilities and do not strive to the fullest to explore alternative answers or strategies for solving problems, even though the opportunity to achieve optimal results exists. Stoltz (2000) also noted that individuals of the camper type tend to persevere in the face of challenges but lack the motivation to explore more complex or innovative solutions.

CONCLUSION

Based on the discussion and data analysis, students' mathematical creative thinking abilities vary notably according to their Adversity Quotient type. In Creative Problem Solving lessons, climbers show strong cognitive potential and commonly meet all four mathematical creative thinking abilities indicators: fluency, flexibility, originality, and elaboration. However, three climber subgroups emerged: those meeting all four indicators, those missing flexibility, and those missing both flexibility and elaboration. In contrast, campers demonstrated similar limitations, generally meeting only the fluency indicator. Students were able to understand the intent of the problems and solve them smoothly. However, they struggled to find alternative ways to solve the problems (flexibility), had difficulty coming up with ideas that were unique and different from others (originality), and were not yet able to present their solution steps in a sequential and detailed manner (elaboration). The campers' tendency to stay within their comfort zones caused them to become satisfied quickly and stop seeking other alternatives. Overall, this study suggests that students' problem-solving intelligence (AQ) plays a crucial role in the creative mathematical thinking process. Teachers need to be aware of these differences so they can provide appropriate guidance to students, thereby helping them reach their full potential.

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