International Journal of Education, Vocational and Social Science
https://e-journal.citakonsulindo.or.id/index.php/IJEVSS
E-ISSN : 2963 4954
IJEVSS

Senior High School Students' Creative Thinking Skills In Mathematical Problem Posing Viewed From Adversity Quotient

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Abstract

This study aims to describe senior high school students' creative thinking skills in mathematical problem posing based on their Adversity Quotient (AQ). This study employed a qualitative descriptive research design with a case study approach. The research subjects consisted of three tenth-grade students representing the climber, camper, and quitter categories. They were selected using purposive sampling based on the results of the Mathematics Ability Test (MAT) and the Adversity Quotient (AQ) questionnaire. Data were collected through tests, questionnaires, mathematical problem-posing tasks, and semi-structured interviews. The trustworthiness of the data was established through time triangulation using Mathematical Problem-Posing Test 1 (MPPT 1) and Mathematical Problem-Posing Test 2 (MPPT 2). The data were analyzed based on the stages of post-solution posing and the indicators of creative thinking skills in mathematical problem posing. The findings revealed that the climber student demonstrated the highest level of creative thinking by fulfilling all components of creativity, namely fluency, flexibility, and originality. The camper student demonstrated fluency and flexibility but did not demonstrate originality. Meanwhile, the quitter student demonstrated only fluency, while flexibility and originality were not evident. These findings indicate that the higher the students' Adversity Quotient, the better their creative thinking skills in mathematical problem posing.

Keywords: Creative Thinking Skills, Mathematical Problem Posing, Adversity Quotient.

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INTRODUCTION

The Merdeka Curriculum has become a relevant educational approach in Indonesia to support the development of 21st-century skills (Rambung et al., 2023). It emphasizes the development of students' creative thinking skills through the implementation of the *Pancasila Student Profile* (Ministry of Education, Culture, Research, and Technology [MoECRT], 2022). Promoting creative thinking has been widely recognized as an essential goal, particularly in mathematics education (Bakker, 2019). This highlights the importance of fostering creative thinking skills in education to prepare future generations for an increasingly dynamic and evolving world.

According to Torrance (1972), creative thinking skills refer to the ability to consider multiple possibilities, apply various approaches, adopt different perspectives, generate novel ideas, and provide direction in producing and selecting alternative solutions. Siswono (2018) further stated that an individual's creative thinking skills can be identified through the products of their thinking or creativity. The Torrance Tests of Creative Thinking (TTCT) is one of the most widely used instruments for assessing creative thinking skills in both children and adults. It evaluates three major components of creativity: fluency, flexibility, and originality (novelty) (Silver, 1997).

Creative thinking skills are considered essential competencies for addressing various challenges more effectively (Kit-Wa et al., 2022). Despite their importance, these skills have not yet been fully developed among most Indonesian students (Agoestanto & Masitoh, 2021). This condition is supported by the Programme for International Student Assessment (PISA) 2022, which reported that Indonesia was among the 14 lowest-performing countries in creative thinking, ranking eighth from the bottom. Furthermore, only 18% of Indonesian students achieved at least Level 2 proficiency in mathematics, where Level 6 represents the highest level of proficiency (OECD, 2024).

These findings indicate that students' creative thinking skills have not yet developed optimally. Therefore, it is important to analyze students' mathematical creative thinking skills to understand the extent to which they are able to apply creative thinking in mathematical contexts. Low creative thinking skills may negatively affect students' learning outcomes (Yusnaeni, 2016). According to the theory of creative thinking, one of its fundamental principles is that creative thinking is not an innate talent but rather a skill that can be learned and developed (Supiadi et al., 2023). One effective approach to developing and identifying creative thinking skills is through mathematical problem posing (Amalina et al., 2018).

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Problem posing encourages students to generate new ideas, making it an effective means of identifying their creative thinking skills (Amalina et al., 2018). Several researchers have employed both problem-posing and problem-solving tasks to identify creative individuals (Silver, 1997). In addition to problem posing, students' intelligence also influences their creative thinking ability. One important factor that significantly affects learning is Adversity Quotient (AQ) (Stoltz, 2000). Stoltz (2000) further classified Adversity Quotient into three categories based on individuals' responses to adversity: quitters (low AQ), campers (moderate AQ), and climbers (high AQ).

A study conducted by Sari (2022) revealed that students' mathematical creative thinking skills differ across Adversity Quotient categories. Students with a high AQ tend to be more resilient in dealing with failure, more persistent in completing challenging tasks, and more innovative in generating solutions. Therefore, understanding how Adversity Quotient influences students' creative thinking skills in mathematical problem posing is an important area for further investigation. Based on these considerations, this study was conducted under the title "Senior High School Students' Creative Thinking Skills in Mathematical Problem Posing Based on Their Adversity Quotient."

RESEARCH METHODS

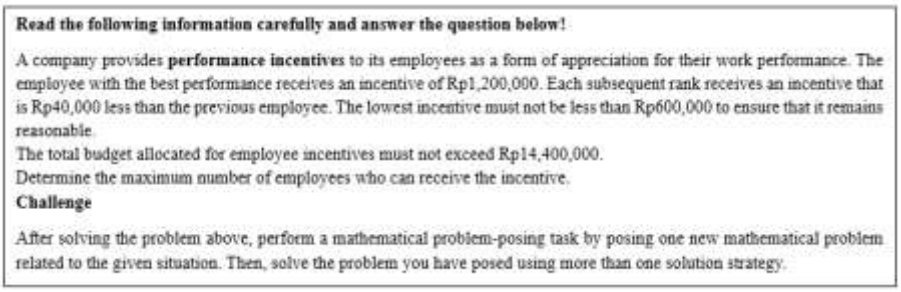
This study employed a qualitative descriptive design with a case study approach. It is classified as qualitative descriptive research because it focuses on describing senior high school students' creative thinking skills in mathematical problem posing based on their Adversity Quotient (AQ). The participants were senior high school students selected from one Grade 10 class with heterogeneous mathematical abilities. The research subjects were selected using purposive sampling. In this study, the subjects were selected based on the Mathematics Ability Test (MAT) and the Adversity Quotient (AQ) questionnaire.

The Mathematics Ability Test (MAT) was administered to select subjects with comparable mathematical abilities, while the Adversity Quotient (AQ) questionnaire was used to classify students into three categories according to their responses to adversity. The AQ categories were determined based on the questionnaire results: Quitters (students with low AQ), Campers (students with moderate AQ), and Climbers (students with high AQ). Consequently, the selection process using the MAT and AQ questionnaire resulted in three research subjects representing different AQ categories while having comparable mathematical abilities.

The data collection techniques employed in this study included tests, mathematical

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problem-posing tasks, and semi-structured interviews, which were conducted to describe senior high school students' creative thinking skills in mathematical problem posing based on their Adversity Quotient. The following is the mathematical problem-posing task used in this study to examine each participant's creative thinking skills.



Read the following information carefully and answer the question below!

A company provides **performance incentives** to its employees as a form of appreciation for their work performance. The employee with the best performance receives an incentive of Rp1,200,000. Each subsequent rank receives an incentive that is Rp40,000 less than the previous employee. The lowest incentive must not be less than Rp600,000 to ensure that it remains reasonable.
The total budget allocated for employee incentives must not exceed Rp14,400,000.
Determine the maximum number of employees who can receive the incentive.

Challenge

After solving the problem above, perform a mathematical problem-posing task by posing one new mathematical problem related to the given situation. Then, solve the problem you have posed using more than one solution strategy.

Figure 1. Mathematical Problem-Posing Task (MPPT)

The three selected subjects were then given Mathematical Problem-Posing Task 1 (MPPT 1) and Mathematical Problem-Posing Task 2 (MPPT 2) for time triangulation. Time triangulation was employed in this study to verify the trustworthiness of the data. The indicators used to analyze creative thinking skills in mathematical problem posing were developed by integrating the main components of creativity proposed by Silver (1997), namely fluency, flexibility, and novelty, with the stages of problem posing proposed by Baumanns and Rott (2022), namely situation analysis, variation, generation, problem solving, and evaluation.

The mathematical problem-posing tasks were also followed by interviews to explore in greater depth information that was not revealed through the written tasks. The interview data were analyzed based on the interactive model proposed by Miles et al. (2014), which consists of data condensation, data display, and conclusion drawing.

Table 1. Indicators of Creative Thinking Skills in Mathematical Problem Posing

Stage	Main Components of Creativity	Indicator	Code
Situation Analysis	Fluency	Generating more than one potential idea that can be developed into a new problem after identifying information and solving the given problem.	F1

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Variation	Fluency	Generating more than one variation of the given problem through modification or the addition of information.	F2
	Flexibility	Varying the problem in different ways, such as changing the context, conditions, or form of the question.	S1
Generation	Novelty	Posing a new problem that differs from the given problem in terms of context, information structure, and form of the question, based on the variations made.	B1
Problem Solving	Flexibility	Using various strategies or methods to solve the problem and adapting them to the requirements of the posed problem.	S2
Problem Solving	Novelty	Solving the posed problem using a method that differs from the strategies commonly used in classroom learning or from strategies previously used by the student.	B2
Evaluation	Flexibility	Evaluating the posed problem and its solution appropriately using more than one approach, such as checking the completeness of information, solution steps, appropriateness of the answer, and clarity of language.	S3

RESEARCH RESULTS

Senior High School Climber Students' Creative Thinking Skills in Mathematical Problem Posing

Based on the research findings, the climber student demonstrated strong creative thinking skills in mathematical problem posing. This was indicated by the fulfillment of the fluency, flexibility, and novelty indicators. These findings are consistent with Sari (2022), who found differences in mathematical creative thinking skills among students with different Adversity Quotient (AQ) categories. Students in the climber category were able to fulfill all three creative thinking indicators: fluency, flexibility, and novelty. Similarly, Wahyuningtyas (2020) found that the creative thinking skills of climber students were categorized as creative because they fulfilled the indicators of fluency, flexibility, and novelty.

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These findings can also be explained by the characteristics of individuals with the climber type of Adversity Quotient (AQ). Climbers are characterized by strong perseverance and a commitment to solving problems thoroughly (Stoltz, 2000). They also tend to be optimistic and able to identify opportunities amid difficulties (Juwita et al., 2020). These characteristics were reflected in the climber student's ability to complete all stages of mathematical problem posing and fulfill the components of fluency, flexibility, and novelty. This finding is also supported by Siswono (2007), who stated that students who fulfill the indicators of fluency, flexibility, and novelty in problem posing are classified at Creative Thinking Level (CTL) 4, or very creative.

At the situation analysis stage, the climber student was able to identify relevant information and solve the problem given by the researcher. At this stage, the student demonstrated fluency, as indicated by the ability to generate more than one idea that could be developed into a new problem. At the variation stage, the climber student fulfilled the fluency and flexibility indicators. Fluency was demonstrated by the ability to generate more than one variation of the problem given by the researcher. Meanwhile, flexibility was demonstrated by the ability to vary the problem in different ways, including changing the context, the given information, and the form of the question.

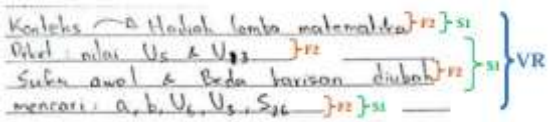


Figure 2. Problem Variations Generated by the Climber Student

At the generation stage, the student fulfilled indicator B1 because the posed problem demonstrated changes in context, information structure, and question form. The problem posed by the climber student is presented below.

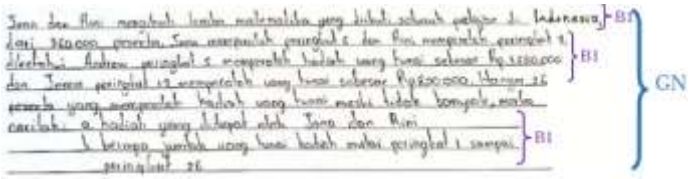


Figure 3. The problem posed by the climber student

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After posing the problem, the climber student wrote a solution to the problem they had posed. Based on the student's written work and excerpts from the interview transcript, the climber student completed the problem-solving stage using two different methods. The use of more than one method demonstrated flexibility, as the student was able to apply various strategies to solve the problem. In addition, the student also fulfilled the novelty indicator in problem solving. This was demonstrated by the student's integration of two mathematical concepts that had previously been learned separately, namely a system of linear equations in two variables and arithmetic sequences and series. The final stage was evaluation. At this stage, the climber student demonstrated flexibility by evaluating the posed problem through checking the completeness of the information, the clarity of the language, and ensuring that the posed problem could be solved.

Senior High School Camper Students' Creative Thinking Skills in Mathematical Problem Posing

The findings showed that the camper student fulfilled the fluency and flexibility indicators but did not fulfill the novelty indicator in mathematical problem posing. This finding is consistent with Sari (2022), who found that students with the camper AQ type fulfilled only two creative thinking indicators, namely fluency and flexibility. This finding is also supported by Wahyuningtyas (2020), who found that camper students generally fulfilled the fluency and flexibility indicators but had not yet demonstrated novelty in creative thinking.

According to Wahyuni (2022), individuals with the camper type still have the willingness to face challenges but tend to become satisfied quickly after reaching a certain level. Stoltz (2000) stated that individuals with the camper type still attempt to solve the problems they encounter but tend to be easily satisfied with the results they have achieved, even when those results are not yet optimal. In addition, Siswono (2007) found that students who fulfill the indicators of fluency and flexibility, or fluency and novelty, are classified at Creative Thinking Level (CTL) 3, or creative.

At the situation analysis stage, the camper student was able to identify relevant information and solve the given problem (Aziza et al., 2025). The student also generated more than one idea that could be developed into a new problem. Therefore, the camper student fulfilled the fluency component at the situation analysis stage. At the variation stage, the camper student was able to vary the given problem. The student fulfilled the fluency indicator by generating more than one variation of the given problem. In addition, the student also fulfilled the flexibility indicator by using various approaches to varying the problem. The problem variations generated

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by the camper student are presented below.

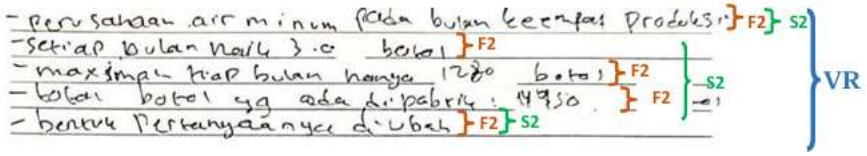


Figure 4. Problem Variations Generated by the Camper Student

Based on the student's written work and excerpts from the interview transcript, the camper student completed the generation stage by developing the variations into a complete new problem. However, the modifications made by the camper student were still limited. The posed problem retained an information structure, question form, and solution strategy that were very similar to those of the problem given by the researcher. This was evident from the camper student's statements that "the problem I posed actually still has many similarities to the given problem" and "the solution method is also almost the same." In addition, the student stated that "the form of the question is still almost the same as that of the problem given by the researcher." Therefore, the posed problem did not demonstrate substantial differences in its information structure and question form. Thus, the camper student did not fulfill the novelty indicator at the generation stage.

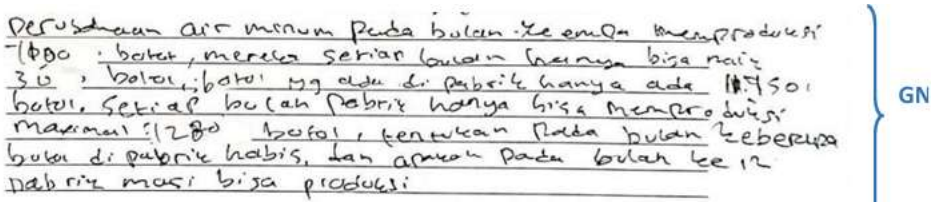


Figure 5. The problem posed by the camper student

At the problem-solving stage, the camper student fulfilled the flexibility indicator because the student had considered alternative solution methods before determining the strategy to be used. This finding indicates that the student was able to consider more than one solution alternative and select the strategy considered most effective. However, the camper student did not fulfill the novelty indicator at the problem-solving stage because the solution strategy used was still very similar to that used in the problem given by the researcher and to strategies commonly encountered in arithmetic sequence and series problems.

At the evaluation stage, the student also fulfilled the flexibility indicator. This was

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demonstrated by the student's ability to use several evaluation strategies, such as checking the clarity of the language, the completeness of the information, the solution steps, and the consistency of the answer with the question posed. In addition, the student ensured that all information in the problem was interconnected and could be used to solve the problem.

Senior High School Quitter Students' Creative Thinking Skills in Mathematical Problem Posing

The findings showed that the quitter student demonstrated limited creative thinking skills in mathematical problem posing. This was indicated by the fulfillment of the fluency indicator, while the flexibility and novelty indicators were not fulfilled. This finding is consistent with Sari (2022), who found that students with the quitter AQ type fulfilled only one creative thinking indicator, namely fluency. Similarly, Wahyuningtyas (2020) found that the creative thinking skills of quitter students were categorized as non-creative because they fulfilled only the fluency indicator. These findings can also be explained by the characteristics of individuals with the quitter type of Adversity Quotient (AQ). Quitters tend to avoid problems, become easily discouraged, give up quickly when facing difficulties, and show little interest in challenges and risks (Stoltz, 2000; Chadha, 2021; Wahyuni et al., 2022).

Furthermore, Siswono (2007) found that students who fulfill only one component of creativity, namely fluency, are classified at Creative Thinking Level (CTL) 1, or less creative. This is consistent with the findings of the present study, which showed that the quitter student fulfilled only the fluency indicator but did not fulfill the flexibility and novelty indicators. Therefore, the quitter student was classified at Creative Thinking Level (CTL) 1, or less creative, in mathematical problem posing. At the situation analysis stage, the quitter student was able to identify relevant information and solve the problem given by the researcher, although the student used a trial-and-error approach to determine the number of terms.

At this stage, the student demonstrated fluency by generating more than one idea that could be developed into a new problem. At the variation stage, the student was able to generate more than one problem variation, indicating the fulfillment of the fluency indicator. However, the modifications were limited to changing numerical values and adding information, which did not reflect different approaches to varying the problem. Therefore, the student did not fulfill the flexibility indicator because the student was unable to vary the problem using different approaches. The problem variations generated by the quitter student are presented below.

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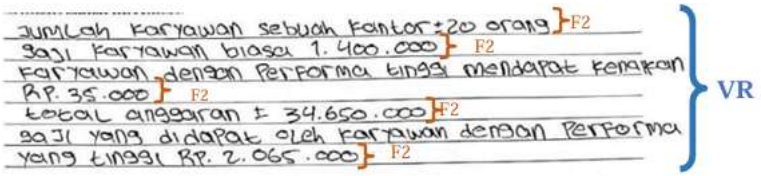


Figure 6. Problem Variations Generated by the Quitter Student

The problem posed by the quitter student was still similar to the problem given by the researcher. The quitter student also stated that the posed problem was less difficult than the problem provided by the researcher. The modifications did not demonstrate meaningful development because the posed problem retained the same context and information structure as the original problem. The posed problem tended to reproduce the original problem with only very limited modifications, resulting in a lower level of problem complexity. Furthermore, excerpts from the interview transcript revealed that the student had previously encountered a similar problem during classroom learning. Therefore, the problem posed by the student did not demonstrate a new idea, indicating that the student did not fulfill the novelty indicator.

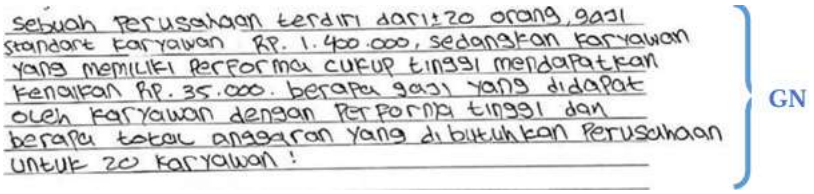


Figure 7. The problem posed by the Quitter student

The problem posed by the quitter student was still similar to the problem given by the researcher. The quitter student also stated that the posed problem was less difficult than the problem provided by the researcher. The modifications did not demonstrate meaningful development because the posed problem retained the same context and information structure as the original problem. The posed problem tended to reproduce the original problem with only very limited modifications, resulting in a lower level of problem complexity. Furthermore, excerpts from the interview transcript revealed that the student had previously encountered a similar problem during classroom learning. Therefore, the problem posed by the student did not demonstrate a new idea, indicating that the student did not fulfill the novelty indicator.

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CONCLUSION

Based on the findings and discussion of senior high school students' creative thinking skills in mathematical problem posing based on their Adversity Quotient (AQ) in the topic of arithmetic sequences and series, the following conclusions were drawn:

1. The *climber* student was classified at Creative Thinking Level (CTL) 4, or highly creative, by demonstrating all three components of creative thinking: fluency, flexibility, and novelty. The student was able to generate diverse ideas and problem variations, pose problems that differed from the initial problem, use more than one solution method, and evaluate various aspects of the posed problems and their solutions.
2. The *camper* student was classified at Creative Thinking Level (CTL) 3, or creative, by demonstrating fluency and flexibility but not novelty. The student was able to generate several ideas and problem variations and consider more than one solution method; however, the posed problems remained similar to the initial problem.
3. The *quitter* student was classified at Creative Thinking Level (CTL) 1, or less creative, by demonstrating only fluency. The student was able to generate an initial idea, but the problem variations remained limited, the posed problems tended to be simpler, the solutions relied on previously learned methods, and the evaluation of the posed problems and their solutions was limited.

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