**The Role of Adversity Quotient in Enhancing Students’ Mathematical Problem-Solving Skills**

**Abstract**

This research is motivated by the low mathematical problem solving ability of students at State Junior High School 19 Kerinci. The purpose of this study is to determine and analyze students' mathematical problem solving abilities in terms of Adversity Quotient (AQ) on quadratic equation material. The problem solving indicators in this study use the problem solving ability indicators according to Polya. This research is a qualitative study. This research was conducted at State Junior High School 19 Kerinci with the subject selection technique used was purposive sampling. The selection of research subjects was based on the results of students' daily test scores on quadratic equation material. The data collection in this study was a mathematical problem solving ability test on quadratic equation material, and an Adversity Quotient questionnaire. Data analysis was carried out using quantitative descriptive techniques, namely summarizing numeric (quantitative) data sequentially and in a structured manner. The results of this study indicate that Adversity Quotient (AQ) can provide significant changes to students' mathematical problem solving abilities, especially in classes IX B and IX C as samples in this study. With this research, it is hoped that mathematics learning in class can be carried out in various ways, so that it can hone and improve students' problem-solving abilities and Adversity Quotient (AQ).

**Keywords:** Problem-solving ability, mathematical, Adversity Quotient, Polya Indicator

**Introduction**

In the 21st century, society is experiencing rapid changes in globalization, demographic transformation, and increasingly advanced technology. This situation encourages the creation of opportunities to explore new, more innovative things for a better and more productive life. Therefore, fundamental educational reform is needed in society in the 21st century (Dewanti et al., 2020) to achieve this goal. The curriculum and learning process must continue to change and develop to respond to and facilitate rapid changes. Rosmana et al. (2022) stated that curriculum changes are needed to organize education, which can reduce the achievement of educational goals and make learning more efficient and effective.

One of the urgencies of curriculum change is ensuring that every student has the quality of thinking and skills that align with the 21st-century era. 21st-century skills are creativity and innovation, critical thinking and problem-solving, and communication and collaboration (Riyanto et al., 2018; Mabunga, 2019; Zubaidah, 2020). Based on previous research, modern society in this century not only needs content knowledge but also needs skills including critical thinking, problem-solving, creativity, innovation, communication, collaboration, flexibility, adaptability, initiative, self-direction, cross-cultural, social, productivity and accountability, leadership, responsibility and information literacy (Rizki & Priatna, 2019; Nimmala & Sultana, 2025). Thus, the focus of 21st-century learning must be directed at the skills most relevant to life in that century.

One of the critical points in mathematics learning that is relevant to 21st-century skills is problem-solving skills. Students' mathematical problem-solving skills impact other learning objectives, making the learning process less active. Hidayat & Sariningsih (2018) and Thuc (2024) state that problem-solving skills are one of the main objectives in mathematics learning. In addition, Maisyaroh, et al. (2019), Aytekİn & Sami (2024), and Markus (2024) also stated that problem-solving skills are the most basic skills in mathematics. In line with this opinion, Bahbah & Erradi (2024), and Patunah et al. (2024) also explained that in mathematics, problem-solving skills are one of the main goals of learning mathematics besides other goals. Thus, it can be understood that problem-solving skills are very crucial in learning mathematics. Therefore, teachers must optimally develop problem-solving skills, especially in mathematics. One effort that can be made to overcome this problem is using appropriate and enjoyable learning models. This aims to prevent students from getting bored easily, be more creative, and potentially facilitate students' ability to solve their problems.

Given the importance of mathematics lessons in problem-solving, it is determined that learning should be centered on students. Student-centered learning makes the learning process more meaningful and can improve the quality of education (Chisara et al., 2018; Malik, 2024). In their research, Qadir et al. (2024) stated that student-centered learning is expected to positively impact the quality of education by involving students more comprehensively in their learning experiences. In addition, in their research, Cahayani et al. (2024) and Martin et al. (2024) also stated that student-focused learning is so that students play an active role, and student-centered learning is needed. Thus, learning-oriented or focused on students is believed to have a more profound impact on the development of student's abilities, including in mathematics learning, especially in problem-solving skills.

To solve problems, everyone has a different strategy or method. However, they generally use the same intelligence known as the adversary quotient. The Adversity Quotient is a person's ability or intelligence to survive in the face of difficulties and be able to solve these difficulties (Stoltz, 2007; Anwar, 2024) and also explained that adversity is often associated with individual abilities related to learning abilities and personal skills development. Several researchers also stated that the Adversity Quotient (AQ) can contribute to developing students' fighting spirit and resilience. Menzies & Jack (2024) and Indah (2025) also explained that the Adversity Quotient is the ability that a person has to observe difficulties and process these difficulties with the intelligence they have so that it becomes a challenge to solve, including in terms of mental health (Saxena, 2025). Thus, AQ is essential to every student's ability to solve mathematical problems. The Adversity Quotient can indicate how someone can overcome their problems, whether they can solve the issues faced to become winners or give up or even stop when experiencing problems that are considered challenging. Students face various obstacles, difficulties, and challenges when solving problems.

Based on some of the explanations above, this study discusses students' mathematical problem-solving abilities with an AQ review. This is intended so that teachers, researchers, and policymakers can take the best steps in the future. This study aims to determine and examine how the analysis of students' mathematical problem-solving abilities is reviewed from the Adversity Quotient.

**Research Method**

This research is included in qualitative research. The qualitative research process involves important efforts, such as asking questions, collecting specific information from participants, analyzing information inductively from specific themes to general themes, and interpreting the meaning of information. Thus, the use of a qualitative approach can help this study in analyzing mathematical problem-solving abilities in terms of students' Adversity Quotient. The subjects in this study were grade IX students of SMP Negeri 19 Kerinci. The subject selection technique used was purposive sampling based on the results of students' daily test scores on quadratic equation material with an Adversity Quotient questionnaire. In this study, the subjects or samples used were students of grades IX B and IX C. The research instrument used was a mathematical problem-solving ability test on quadratic equation material with an Adversity Quotient questionnaire. Therefore, the questions were made as an instrument to identify indicators of mathematical problem-solving abilities consisting of 5 questions arranged in the form of descriptions. The main consideration of such questions is to explore as many ideas and information as possible from students so that each research subject can be known completely based on the indicators of students' mathematical problem-solving abilities. In addition to test questions, another instrument used in the study was the Adversity Quotient Questionnaire. A questionnaire is a non-test instrument in the form of a list of questions that must be answered by the subjects in the study (Sugiono, 2019). The Adversity Quotient questionnaire contains questions about the characteristics of quitters, campers and climbers. Stolz (2007) stated that to measure a person's Adversity Quotient, an instrument called the Adversity Responsive Profile (Profile of response to difficulties) is used. The Adversity Responsive Profile (ADP) contains questions that describe an event. In each event there are two questions, namely positive questions and negative questions. Before the Adversity Quotient questionnaire instrument is used in the study, the instrument is first validated by providing a validation sheet to the validator. This validation is carried out to reduce errors in the research data processing process which will certainly have an impact on the end of a study. Before being used in research, all instruments were first validated by experts. Data analysis was carried out using quantitative descriptive techniques, namely summarizing numerical (quantitative) data sequentially and in a structured manner.

**Results and Discussion**

As previously stated, the research was conducted at SMP Negeri 19 Kerinci in the odd semester of 2024/2025 on September 2 to October 2, 2024. The background is that the mathematical problem-solving ability of students at SMP Negeri 19 Kerinci is still not optimal, especially in the quadratic equation material. One of the reasons for the suboptimal ability is the lack of mastery of the material. This situation causes errors and difficulties for students in solving the problems given. The results of the study conducted on September 12, 2024 by conducting a test on the subjects, namely the mathematical problem-solving ability test, showed that the results of these abilities were very diverse. In general, these results can be seen in Table 1 below:

Table 1 Results of Mathematical Problem Solving Ability

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Student Code** | **Score** | **Criteria** | **Student Code** | **Score** | **Criteria** |
| B1 | 73.84 | Good | C1 | 60 | Enough |
| B2 | 75.38 | Good | C2 | 73.84 | Good |
| B3 | 86.15 | Very Good | C3 | 29.23 | Very Poor |
| B4 | 56.92 | Fair | C4 | 73.84 | Good |
| B5 | 78.46 | Good | C5 | 76.92 | Good |
| B6 | 89.23 | Very Good | C6 | 84.61 | Very Good |
| B7 | 70.76 | Fair | C7 | 44.61 | Less |
| B8 | 61.53 | Good | C8 | 33.84 | Very Poor |
| B9 | 73.84 | Fair | C9 | 73.84 | Good |
| B10 | 87.69 | Good | C10 | 80 | Good |
| B11 | 56.92 | Very Good | C11 | 27.69 | Very Poor |
| B12 | 33.84 | Fair | C12 | 73.84 | Good |
| B13 | 73.84 | Very Poor | C13 | 76.92 | Good |
| B14 | 58.46 | Good | C14 | 87.69 | Very Good |
| B15 | 44.61 | Fair | C15 | 60 | Enough |
| B16 | 72.30 | Fair | C16 | 35.38 | Very Poor |
| B17 | 60 | Fair | C17 | 41.53 | Less |
| B18 | 60 | Good | C18 | 66.15 | Enough |
| B19 | 76.92 | Fair | C19 | 67.69 | Enough |
| B20 | 36.92 | Fair | C20 | 81.53 | Good |
| B21 | 58.46 | Good | C21 | 61.53 | Enough |
| B22 | 72.30 | Very Poor | C22 | 41.53 | Less |

Based on the problem-solving ability above, the results of the mathematical problem-solving ability test of students varied; class IX B, with 22 students, obtained an average score of 66.29, and class IX C, with 22 students, obtained an average score of 61.47. Thus, it can be understood that, in general, classes IX B and IX C have a category of "sufficient" mathematical problem-solving ability. The following is the percentage of scores obtained for each aspect of mathematical problem-solving ability of students in classes IX B and IX C are as follows:

Figure 1. Percentage of Mathematical Problem-Solving Ability of Class IX B Students

Figure 2. Percentage of Mathematical Problem-Solving Ability of Class IX C Students

Next, the researcher gave a questionnaire to students to see the AQ type of each student. Subjects were taken based on the results of the AQ questionnaire and the results of the answer sheets of class IX B and class IX C students. There were 22 class IX B students, namely 3 students with the Quitter type, 10 with the Camper type, and 9 with the Climber type. There were 22 class IX C students, namely 7 students with the Quitter type, 8 with the Camper type, and 7 with the Climber type. Furthermore, one subject was taken from each type by looking at the problem-solving ability indicator. The following are the results of data processing from the Adversity Quotient questionnaire of class IX B and class IX C students of SMP Negeri 19 Kerinci, which can be categorized as follows:

Table 2 Results of Adversity Quotient Level of Class IX B and Class IX C Students

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Score Range** | **Frequency of Class IX B** | **Percentage** | **Frequency of Class IX C** | **Percentage** | **Category** |
| 0 ≤ AQ < 85 | 3 | 13.64% | 7 | 31.82% | Quitter (Low) |
| 95 ≤ AQ < 135 | 10 | 45.45% | 8 | 36.36% | Camper (Moderate) |
| AQ ≥ 135 | 9 | 40.91% | 7 | 31.82% | Climber (High) |

For more precise results, the table can be seen in the form of a graph of the Adversity Quotient levels of class IX B and class IX C students at SMP Negeri 19 Kerinci as follows:

Figure 3. Percentage of Adversity Quotient Level of Class IX B Students

Figure 4. Percentage of Adversity Quotient Level of Grade IX C Students

In the discussion section, the researcher will discuss several results of the data analysis that have been obtained. The discussion includes 1) interpretation of research results, 2) comparison of research results with theory, and 3) comparison of research results with relevant research. The data analysis results were conducted after conducting a mathematical problem-solving ability test for students and distributing the Adversity Quotient questionnaire. The following is a further explanation of the research results obtained.

1. Mathematical Problem-Solving Ability Test

a. It was found that 13.63% of class IX B students and 9.09% of class IX C students, or 3 students from class IX B and class IX C, had excellent mathematical problem-solving ability. This shows that students have demonstrated their ability to solve mathematical problems very well, namely consistently implementing the stages of problem-solving ability according to Polya and using material concepts to solve problems.

b. It was found that 40.9% of class IX B students, or 9 students, and 36.36% of class IX C students, or 8 students, had good problem-solving ability. This shows that students have demonstrated their ability to solve problems well, namely by the stages of problem-solving ability according to Polya, but not optimally, which means that there are still a few errors in the stages of problem-solving ability and in using material concepts to solve problems.

c. It was obtained that 31.8% of class IX B students, or 7 students, and 22.72% of class IX C students, or 5 students, had sufficient problem-solving ability. This shows that students can demonstrate their ability to solve problems in the adequate category. However, some students are still not optimal in solving problems and are inconsistent in carrying out these stages, such as forgetting some stages of problem-solving.

d. It was found that 4.54% of class IX B students, or 1 student, and 13.63% of class IX C students, or 3 students, had low problem-solving skills. This shows that students are still not optimal in solving problems and still have difficulty with the problem-solving strategies given.

e. It was found that 9.09% of class IX B students, or 2 students, and 18.18% of class IX C students, or 4 students, had very low problem-solving skills. This shows that students are still not optimal in solving problems and still have difficulty with the problem-solving strategies given.

Referring to the study's results above, it can be understood that Adversity Quesit supports the development of deeper and more diverse problem-solving skills. By allowing students to find their solutions or strategies in guided situations, they learn to think creatively, explore various approaches, and test the truth of their thinking. Overall, the Adversity Quotient provides greater opportunities for students to develop deep understanding, flexible problem-solving skills, and intrinsic motivation toward mathematics.

The results of the analysis show that there is an increase in students' mathematical problem-solving abilities. This study's results align with previous studies, especially research conducted by Lestari et al. (2024) that shows that AQ affects students' metacognitive skills. In addition, the results of the study by Prasetyo et al. (2024) also found that AQ affects students' statistical literacy abilities. In line with the results of the survey, Himmah & Ayun (2024) that AQ affects mathematics learning achievement with a determination coefficient value of 0.650, which means that the percentage of AQ's influence on mathematics learning achievement is 65.0%. Thus, AQ theoretically and practically positively impacts improving students' abilities, including problem-solving skills in learning mathematics. Therefore, the study's results have strengthened the arguments of the results of previous studies.

Using the AQ approach in mathematics learning, students can solve real problems and develop their mathematical problem-solving abilities for good learning outcomes. A person's fighting spirit influences student success in solving problems towards a problem known as the Adversity Quotient (Hidayat & Sariningsih, 2018). Adversity Quotient is very important for students to have during learning, especially in working on problem-solving questions, so that when difficulties and obstacles arise in solving mathematical problems, students can overcome them. This aligns with the opinion of Safira et al. (2024) that AQ can also be interpreted as an individual's potential ability to demonstrate persistence, mental intelligence, resilience, or resilience intelligence. AQ has a vital role in determining the extent to which students can overcome challenges in the learning process, especially in understanding complex mathematical concepts.

As with problem-solving skills, students' Adversity Quotient also needs more attention because many students in Indonesia still give up easily in solving mathematical problems they face. In Sakrani's (2014) study, students tend to stop when they feel they have not found the final solution to a problem because they consider it beyond their capabilities. In line with the theory above (Afri, 2018), the Adversity Quotient significantly influences mathematical problem-solving skills. As stated in Arfi (2018), the study of Leonard & Amanah (2014) also shows that the level of the Adversity Quotient of students affects the level of critical thinking skills of students when dealing with problems, both difficulties and failures. Students with a high Adversity Quotient will likely face and solve problems. The opposite also applies; students with a low Adversity Quotient are supposed to give up more easily when facing difficulties. This aligns with research conducted by Alya Husna Choirunnisa (2022) regarding the influence of Adversity Quotient on Students' Mathematical problem-solving ability. Data analysis shows a positive impact of the Adversity Quotient on students' mathematical problem-solving ability. The findings prove that there is an increase in students' problem-solving skills. These findings align with the findings of Malik & Mariani (2019) entitled "Ability in Mathematics Problem Solving Based in Adversity Quotient." The research findings prove similarities and differences with the findings that researchers have found; the similarities are based on students' problem-solving abilities and Adversity Quotient, and the differences lie in the research object.

Based on the results of previous research, it has been proven that Adversity Quotient can indeed affect students' mathematical problem-solving abilities, namely research conducted by Darmawan (2019) entitled "Mathematics Learning/achievement of Vocational High School Students' Viewed by Adversity Quotient." In this study, there are similarities and differences with the research conducted by researchers; among the similarities, namely, both want to see based on Adversity Quotient. The difference in this study is the object of research; researchers researched junior high school students while this study was conducted in vocational schools. Improving mathematical problem-solving abilities for students has a broad and significant impact on the learning process and the future. Strong mathematical problem-solving skills can improve students' academic achievement in mathematics and other fields of study that require critical and analytical thinking; students skilled in solving mathematical problems tend to have better critical thinking skills. They can identify issues, analyze information, and evaluate solutions effectively.

**Conclusion**

This study reveals that while students demonstrate problem-solving abilities, their performance is not yet optimal according to Polya's stages of problem-solving. Specifically, minor errors persist in applying problem-solving stages and material concepts. To address this, fostering students' Adversity Quotient (AQ) through targeted support could enhance their overall problem-solving skills. More efforts are needed to improve students' Adversity Quotient (AQ), especially teachers. Teachers must help students strengthen their Adversity Quotient (AQ) and mathematical problem-solving abilities.

**Disclaimer (Artificial intelligence)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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