Available online at: http://journal.uny.ac.id/index.php/jpip

Jurnal Penelitian Ilmu Pendidikan
Volume 7, Nomor 2, 87 – 98, 2024

Mathematical problem-solving ability of 5th grade students based on adversity quotient

Siti Munawwarah[1]*, Aprilia Tina Lidyasari[2], and Verawati Munafiroh[3]

[1,2,3]Fakultas Ilmu Pendidikan, Universitas Negeri Yogyakarta, Sleman, D. I. Yogyakarta, Indonesia
Corresponding Author. e-mail: sitimunawwarah.2023@student.uny.ac.id

Abstract
This study investigates fifth-grade students' mathematical problem-solving abilities based on their Adversity Quotient (AQ) types and identifies error patterns across Polya's problem-solving stages. Employing a descriptive qualitative design, the research was conducted at Keputran 2 Elementary School, Yogyakarta, involving 24 purposively selected students. Data were obtained through the Adversity Response Profile (ARP) questionnaire and a mathematical problem-solving test. The AQ results categorized students into four climbers, seven campers, and thirteen quitters. One student from each AQ type was further analyzed through their written responses. Findings revealed that climber-type students successfully completed all stages of Polya's framework, demonstrating perseverance and accuracy yet showing limited reflective evaluation. Camper-type students completed all stages inconsistently, particularly in verifying their results. Quitter-type students were unable to complete the stages, displaying conceptual and procedural misconceptions. The study concludes that differentiated instructional strategies are essential: quitters benefit from contextualized tasks and extrinsic motivation; campers require scaffolded feedback; and climbers need challenging problems to foster deeper reflection. These insights emphasize the pedagogical importance of integrating AQ-based differentiation to enhance mathematical problem-solving competence among elementary students.
Keywords: Adversity quotient; problem solving; mathematics; elementary school

How to Cite (APA): Munawwarah, S., Lidyasari, A. T., & Munafiroh, V. (2024). Mathematical problem-solving ability of 5th grade students based on adversity quotient. *Jurnal Penelitian Ilmu Pendidikan,17*(2), 87 – 98. doi: https://doi.org/10.21831/jpip.v17i1.90771

Received 17-07-2024; Received in revised from 20-08-2024; Accepted 18-09-2024

INTRODUCTION

The mathematics learning process emphasizes the development of key competencies which include (1) problem solving, (2) reasoning and proof, (3) communication, (4) connections, and (5) representation (Niss & Højgaard, 2020). Mathematical problem solving ability is considered to be the core of mathematics learning, as it trains individuals to respond systematically to challenges (Omiralievna, 2024; Ortiz, 2016). Mathematical problems are defined as situations that require active effort to find a solution, where an immediate response is not available (Kania et al., 2022). Solving patterns generally involve the stages of understanding the problem, planning a strategy, executing the plan, and reflecting on the results (Fahrudin et al., 2019; Nurkaeti, 2018; Polya, 1945).

In the context of contemporary learning dynamics, *Adversity Quotient (AQ)* is increasingly recognized as a critical factor influencing problem-solving effectiveness. AQ refers to an individual's ability to face adversity, endure pressure, and turn obstacles into opportunities (Istiqomah et al., 2021; Stoltz, 1997). Recent research suggests that AQ is not only related to psychological resilience, but also plays a role in cognitive processes such as decision-making and strategy adaptation when facing complex problems (Hakim & Murtafiah, 2020; Juwita et al., 2020; Saxena & Rathore, 2025). For example, students with a *climber* AQ profile tend to show persistence and flexibility in exploring alternative solutions, while *quitter* types give up more easily when facing difficulties (Anwar et al., 2024; Ika Putri Wulandari & Sugianto, 2019; Istiqomah et al., 2021).

Preliminary observations in the Kemantren Kraton cluster of Yogyakarta in 2025 revealed a tendency for 47 out of 98 fifth-grade students to avoid non-routine problems, with only 18 of them actively making an effort. This low engagement is not only caused by cognitive weaknesses (such as inability to model story problems, procedural errors in fraction operations, or weak mastery of basic operations), but is also thought to be associated with low student AQ. A low Adversity Quotient essentially a lack of perseverance in adversity was reflected in students' failure to construct mathematical arguments or identify simple number patterns when facing cognitive pressure. Reliance on rote methods and avoidance of non-routine problems indicate a lack of resilience and adaptability in the learning process. These findings underscore the urgency of exploring non-cognitive factors such as AQ, which may act as catalysts influencing students' perseverance and strategies during problem-solving stages.

Recent studies on mathematics problem solving have examined various cognitive factors such as early numeracy (Bolstad, 2023; Chang, 2023; Rakhmawati & Mustadi, 2022; Siregar et al., 2022) and metacognition (Bakar & Ismail, 2020; Szabo et al., 2020). Other studies focus on pedagogical factors, including the influence of learning approaches and the role of teacher feedback (Karan & Brown, 2022; Kusuma et al., 2021; Musna et al., 2021; Rasyid et al., 2023; Smith et al., 2022). In addition, non-cognitive aspects have been explored, such as learning motivation (Mafugu, 2024; Nasution et al., 2024) and math anxiety (Anwar et al., 2024; Istiqomah et al., 2021; Poçan et al., 2023; Tanjung et al., 2021). However, to our knowledge, no research has specifically examined the relationship between AQ and mathematical ability, especially in the context of mathematical problem solving at the elementary school level – a developmental stage where students transition toward more formal operational thinking. This gap emphasizes the need for a holistic investigation of how AQ profiles (quitter, camper, climber) interact with the stages of problem solving, particularly at the primary education level.

Based on this urgency, the present study aims to analyze the mathematical problem-solving ability of fifth-grade elementary school students based on their Adversity Quotient (AQ) type. Specifically, this study investigates the characteristics of mathematical problem-solving skills of students with AQ profiles of quitter, camper, and climber with reference to Polya's stages, and identifies patterns of misconceptions that appear at each stage of problem solving according to AQ category. This study is expected to enrich the pedagogical perspective by integrating the psychological dimension (AQ) into the analysis of mathematical ability, addressing the need for a holistic approach in mathematics learning that considers students' psychological resilience and adaptability

METHODS

Participants

This research is a descriptive study with a qualitative approach. The study involved 24 fifth-grade students of SDN Keputran 2 Yogyakarta, Indonesia. The research methods are detailed as follows.

Measures

This study used two main instruments: an Adversity Quotient (AQ) questionnaire and a mathematics problem-solving test. The AQ questionnaire was developed based on Stoltz's (1997) theory, with modifications for the context of elementary students' mathematics learning. It included dimensions of Control, Ownership, Origin, Reach, and Endurance. A *Frequently–Sometimes–Never* Likert scale was used to measure students' responses to statements related to resilience in facing math difficulties (see Table 1). The instrument was validated by one expert (education lecturer) and a fifth-grade teacher to ensure clarity of language, relevance of indicators, and suitability to the cognitive level of elementary students. A reliability test yielded a Cronbach's Alpha coefficient of 0.76, indicating adequate internal consistency.

Table 1. Adversity quotient scale questionnaire indicators

Dimensions	Number of Items	Item Type	
		Favorable	Unfavorable
Control	6	1, 4, 11, 17	10, 12
Ownership	6	1, 4, 17	10, 14, 20
Reach	4	2, 13	5, 18
Endurance	4	9, 19	8, 12
Total	6	6, 11, 15	3, 7, 16

Meanwhile, the problem-solving test consisted of two elementary-level math problems (on fractions and geometry). Problem 1 reads: *"Mom went to the supermarket to buy ingredients. She bought 1/3 kg of sugar and 1/6 kg of flour. What is the total weight of the groceries she bought?"* Problem 2 reads: *"A field as shown (soccer field) is 90 meters long and 45 meters wide. What is the shape of the field? What is the area of the field?"* These questions were validated by experts to ensure they aligned with problem-solving indicators, and were consulted with the fifth-grade teacher to match difficulty levels with student abilities and to use clear, contextual language. Table 2 shows the indicators for the students' math problem-solving test based on Polya's stages.

Table 2. Math problem solving test indicators

Question Number	Polya's Stages	Question Indicator
1	Understanding the Problem	Students are able to identify data (1/3 kg and 1/6 kg) and objectives (total weight).
	Planning the Solution	Students plan the addition of fractions with the same denominator.
	Implementing the Plan	Students add 1/3 + 1/6 correctly (result: 1/2 kg).
	Evaluating Results	Students verify answers (e.g. rechecking fraction operations).
2	Understanding the Problem	Students recognize the field shape (rectangle) and data (90 m long, 45 m wide).
	Planning the Solution	Students choose the formula for the area of a rectangle (length × width).
	Implementing the Plan	Students calculate the area (90 m × 45 m = 4,050 m^2).
	Evaluating Results	Students verify answers (e.g. checking multiplication or units).

Data Collection

Data were collected by administering the ARP AQ questionnaire to 24 students to determine each student's AQ type, and by administering the problem-solving test to assess each student's problem-solving performance based on Polya's stages. Based on the questionnaire results, 4 students were categorized as *Climber*, 7 as *Camper*, and 13 as *Quitter*. From these groups, three representative students (one climber, one camper, and one quitter) were selected for in-depth analysis of their test answer sheets. The selection of these subject students was based on the uniqueness of their answer patterns exemplifying each AQ type. For confidentiality, the climber student is coded SCI, the camper student SCA, and the quitter student SQU. The questionnaire and test results were analyzed with respect to student performance on each of Polya's problem-solving indicators.

Data Analysis

Data analysis was conducted both quantitatively and qualitatively. The quantitative analysis served to categorize students into AQ groups based on their ARP questionnaire scores. The AQ category criteria are shown in Table 3. Qualitative analysis focused on evaluating the students' written test answers using a rubric aligned with Polya's stages. This rubric included four indicators: (1) ability to identify key information and represent the problem, (2) accuracy of strategy selection, (3) accuracy of mathematical operations, and (4) reflection and error checking. Qualitative data were then analyzed thematically to identify patterns in strategies, errors, and the dynamics of student perseverance corresponding to each AQ category. Triangulation was carried out by comparing the quantitative results (AQ scores) with the qualitative findings (answer patterns) to strengthen the validity of interpretations.

Table 3. Students' adversity quotient category

Adversity Category	Score Interval	Description
Climber (High)	46-60	Students are persistent, optimistic and responsible. They are able to manage stress, try new strategies and see challenges as learning opportunities.
Camper (Medium)	31-45	Students have sufficient resilience, but still hesitate or rely on the help of others. They can make an effort, but not consistently.
Quitter (Low)	20-30	Students tend to give up easily, lack confidence and avoid challenges. They often blame external factors and feel math is not important.

Qualitative analysis focused on evaluating the test answer sheets using a rubric based on Polya's stages. This rubric includes four indicators: (1) ability to identify key information and represent the problem mathematically, (2) accuracy of strategy selection, (3) accuracy of mathematical operations, and (4) reflection of errors. Qualitative data were thematically analyzed to identify patterns of strategies, errors, and dynamics of student perseverance based on AQ categories. Triangulation was conducted by comparing quantitative results (AQ scores) and qualitative findings (answer patterns) to strengthen the validity of the interpretation

RESULTS AND DISCUSSION

Results

Based on descriptive statistical analysis of 24 fifth grade students of SDN Keputran 2 Yogyakarta, the distribution of Adversity Quotient (AQ) categories reflecting their responses in facing challenges was identified as illustrated in Table 4.

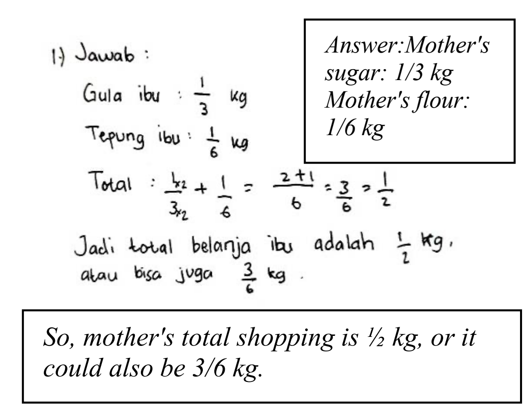
Table 4. Demographics of Research Subjects Based on Adversity Quotient

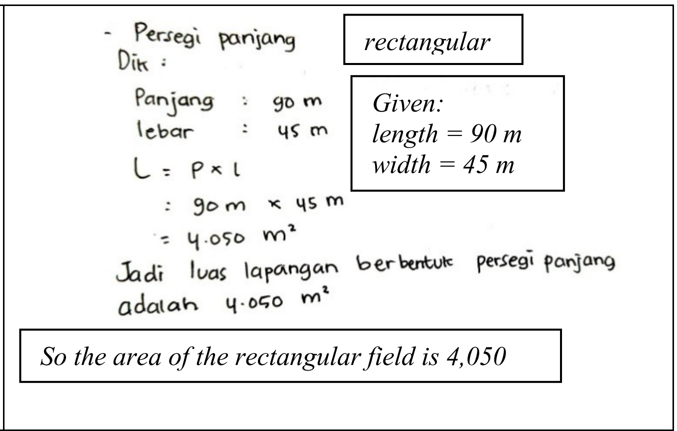
AQ Category	Frequency	Percentage
Climber	4	17
Camper	7	29
Quitter	13	54
Total	24	100

Table 4 presents the demographic distribution of research subjects based on Adversity Quotient (AQ) categories, consisting of 24 students with the largest percentage in the Quitter category (54% or 13 students), indicating the tendency of the majority of subjects to have relatively low motivation and fighting power in facing challenges. This data indicates that most of the research participants are on the spectrum of AQ that needs to be improved, thus becoming the focus of further analysis related to pedagogical or psychological implications in the context of problem solving. Furthermore, the problem-solving characteristics of each AQ type are explained as follows.

Mathematics Problem Solving Ability of Climber Type Students (SCI)

The SCI's answer sheet in the math problem solving ability test can be seen in Figure 1.





SCI Answer Problem 1	*SCI Answer Problem 2*

Figure 1. SCI answer snippet

From all stages of Polya, SCI is able to apply all steps of problem solving. At the stage of understanding the problem, students can identify key information obtained from the problem including what is known and asked. In Problem 1, students capture numerical data (1/3 kg and 1/6 kg) as well as the purpose of adding up the weight of groceries. In Problem 2, students recognize the context of geometry by mentioning "rectangle" and relate the length-width measure to calculate the area.

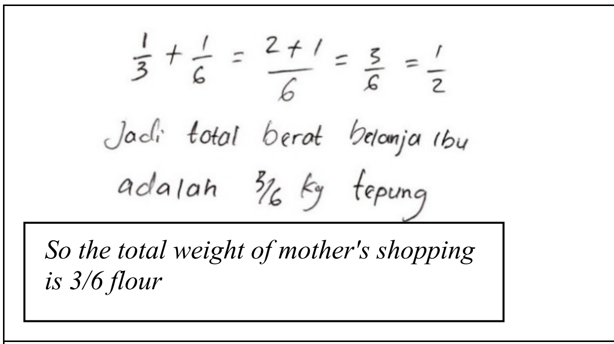
At the solution planning stage, SCI was able to choose the right strategy for each problem. In Problem 1, SCI chose the addition method to solve the given problem. The plan to equalize the denominator of the fractions by using multiples (1/3 = 2/6) showed an understanding of the concept of fraction addition. In Problem 2, the use of the formula Area of a rectangle= length× width reflects the ability to choose a logical strategy and method in accordance with the characteristics of the problem.

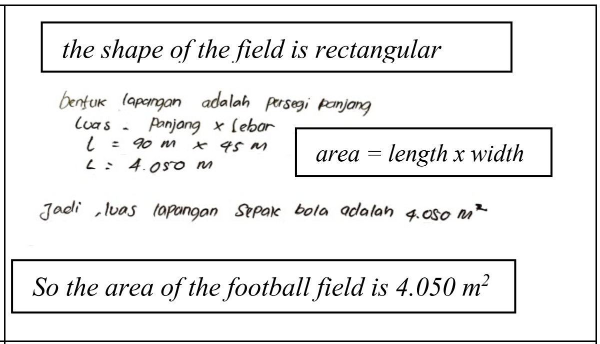
At the stage of implementing the solution, SCI carried out mathematical operations accurately. In Problem 1 and 2, SCI was able to carry out the planned strategy well, seen from the accuracy of the answers given. In Problem 1, SCI also gave the answer in the simplest form, showing well-integrated procedural skills and concept understanding.

At the stage of checking the results, SCI was able to make conclusions correctly. SCI was able to use all the information obtained to help solve the problem. SCI also rechecked the results of his work and had alternative solutions in other ways. It can be seen when SCI gave an alternative answer to Problem 1 (3/6 or ½).

Math Problem Solving Ability of Camper Type Students (SCA)

The answer sheet of Camper type students in the math problem solving ability test can be seen in Figure 2





SCA Answer Problem 1	SCA Answer Problem 2

Figure 2. SCA's answer snippet

The answer sheets of camper-type students (SCA) showed basic abilities in solving mathematical problems, although there were some limitations at certain stages. At the stage of understanding the problem, SCA was able to capture the numerical data in Problem 1 (1/3 kg and 1/6 kg) but did not associate it with the right context. SCA's understanding of the problem is only seen from her accuracy in using the addition symbol, although it is not accompanied by context information. In Problem 2, the student successfully understood the geometry context by identifying the shape of the rectangle and the purpose of calculating the area, showing good analytical skills for structured problems.

In the solution planning stage, SCA tended to jump straight to execution without formulating the strategy explicitly, especially in Problem 1. Despite using denominator equalization (1/3 = 2/6), there was no written explanation of the reason for choosing the method. However, in Problem 2, the student was able to plan the solution appropriately using the rectangular area formula, showing the ability to choose an appropriate strategy when the problem was clearly understood.

At the solution implementation stage, SCA performed mathematical operations procedurally. In Problem 1, the addition of fractions (2/6 + 1/6 = 3/6) was carried out correctly to the simplest result of ½ kg. Contextual errors such as the mention of "flour" also indicated a lack of accuracy. Meanwhile, in Problem 2, students managed to calculate the area accurately using the length × width formula, without procedural errors.

In the stage of checking the result, SCA has not been consistent in evaluating the answer. In Problem 1, students did not recheck to simplify 3/6 to ½ or correct context errors. The alternative answer (3/6) was maintained without correction even though the calculation had obtained the simplest result.

In general, SCA has adequate basic procedural skills, especially in mathematical operations such as fraction addition and area calculation. However, students need to improve in understanding the context of the problem, planning the solution systematically, and checking the results critically. The weakness in Problem 1 shows the importance of practice in linking numerical data with real contexts, while the success in Problem 2 reflects the potential of SCA in solving structured problems when the solution steps are fully understood.

Mathematics Problem Solving Ability of Quitter Type Students (SQU)

The answer sheet of Quitter type students in the math problem solving ability test can be seen in Figure 3.

$\frac{1}{3}+\frac{1}{6}=\frac{2}{9}$ kg Saya lupa bu *I am forgetting miss*	$90+90+45+45=270$ cm
SQU Answer Question 1	*SQU's answer to question 2*

Figure 3. SQU's answer snippet

The answer sheets of quitter-type students (SQU) reflect the inability to fulfill all stages of Polya's problem solving. At the problem understanding stage, students failed to identify key information from the problem. In Problem 1, despite the presence of numerical data, students did not clearly explain the context or purpose of the question. In Problem 2, students did not even recognize basic elements such as geometric shapes or the purpose of the calculation, as evidenced by irrelevant answers or random scribbles.

In the solution planning stage, SQU did not show any effort to design a strategy or choose the right method. In both problems, students directly wrote the answers without explaining the steps. For example, in Problem 1, the fraction addition operation was performed without logical reasoning and inappropriately, while in Problem 2, there was no indication of using the appropriate area formula or geometry parameters. This shows that students' understanding of mathematical concepts is very low so SQU failed to plan the solutions needed to solve the problem.

At the solution implementation stage, the answer execution process was inaccurate and unsystematic. In Problem 1, the addition of fractions (1/3 + 1/6 = 2/9) showed a fundamental procedural error. SQU failed to understand the concept of addition by simply adding numerator to numerator and denominator to denominator. While in Problem 2, the calculation of area or perimeter did not follow the correct formula at all, or there was even no structured calculation effort. The writing of units is also done arbitrarily and does not follow the rules of writing units.

In the stage of checking results, students did not evaluate the answers given. Conceptual (e.g. inappropriate units) or procedural (e.g. addition without equalizing denominators) errors are left uncorrected. Final answers were often incomplete or illogical, such as random numbers or statements not related to the problem.

From Polya's four stages, SQU showed fundamental incompetence in all aspects of mathematical problem solving. Failure to understand the context, plan strategies, perform operations, and verify results indicates a lack of motivation or understanding of basic concepts. To improve, students need intensive training in reading problem instructions, designing systematic solution steps, and building the habit of evaluating answers. An approach that focuses on strengthening basic mathematical concepts and structured practice can help students overcome these barriers.

Discussion

The results revealed that the *Quitter* category (low AQ) was dominant among the fifth-grade students of SDN Keputran 2 Yogyakarta, comprising 54% of the sample (13 out of 24 students). The predominance of quitter-type students reflects systemic challenges such as a memorization-based learning culture and a lack of mental resilience in mathematics learning (Istiqomah et al., 2021). This finding underscores the urgency for pedagogical interventions that not only reinforce mathematical concepts but also explicitly build resilience and persistence, especially at the elementary level where problem-solving foundations are laid. Consistent with the study's analysis, students with different AQ profiles exhibited distinctly different problem-solving abilities: climber students showed better problem-solving performance than camper and quitter students.

Climber students (high AQ) consistently applied all stages of Polya's problem solving from understanding the problem through planning, execution, and checking the results more thoroughly than the other groups (Fauziah et al., 2020; Yustiana et al., 2021). This aligns with the notion that students with strong problem-solving skills (often corresponding to high AQ) tend to take greater responsibility for their own learning process and outcomes, enabling them to effectively face and overcome various academic (Anwar et al., 2024; Bakar & Ismail, 2020; Juwita et al., 2020). This observation is in line with Stoltz's (1997) theory of AQ, which posits that individuals with high AQ not only persist in difficult situations but also take ownership of their efforts and results. In the context of this study, the climber-type student demonstrated a high degree of persistence, accuracy, and willingness to double-check work traits that exemplify high AQ and contribute to successful problem solving.

Camper students (moderate AQ) showed intermediate problem-solving capabilities: procedurally, they could handle basic operations, but they were less consistent in understanding the full context of problems and in self-evaluation. This indicates that having some resilience (moderate AQ) is not a substitute for solid conceptual understanding or habits of critical reflection. The pattern observed in the camper student supports findings by Istiqomah et al. (2021), which noted that a moderate AQ is often associated with reliance on external help and a lack of independent reflection. Such inconsistency in performance highlights the need for scaffolded, formative feedback to foster greater independence in problem solving (Acosta-Gonzaga & Ramirez-Arellano, 2022; Mutaqin et al., 2021). In practice, this could involve providing hints or guiding questions that encourage camper-type students to reflect on their approach and check their answers, thereby gradually building their confidence and self-reliance.

Meanwhile, quitter students (low AQ) experienced systematic difficulties across all of Polya's stages, from conceptual misunderstandings to an avoidance of strategic problem-solving altogether. This finding is consistent with research by Apriyani and Uyun (2023) and (Yuniara et al., 2023), which reported that students with low AQ tend to have a pronounced fear of failure and disengage from challenging tasks. The procedural errors observed such as the arbitrary addition of fractions reinforce analyses by Rahmayantri and Priatna (2022) regarding weak mastery of basic operations among low-performing students. The dominance of quitters in the sample suggests a need for differentiated teaching approaches tailored to students with low AQ. For example, using simple, contextual problems can help reduce math anxiety and build initial confidence, gradually changing students' perceptions of challenges (Djatmika & Astutik, 2023; Padliadi et al., 2020). By starting with familiar contexts and achievable steps, quitter-type students might develop greater resilience and a willingness to engage with more complex problems over time.

Holistically, this study extends the discourse on mathematical problem solving by integrating the AQ dimension, thereby highlighting the interaction between psychological factors and academic performance (Anwar et al., 2024; Bakar & Ismail, 2020; Juwita et al., 2020). The pedagogical implications emphasize the importance of adaptive learning strategies that consider students' adversity profiles. In practical terms, climber-type students could be given open-ended or challenging problems to further stimulate critical thinking and prevent complacency. Camper-type students might benefit from problem-based learning environments enriched with timely feedback, to bridge their partial understanding and encourage reflection. Quitter-type students likely need more external motivation and highly contextualized learning experiences to re-engage them in the problem-solving process. In summary, this study not only fills a gap in the literature regarding AQ at the primary education level but also offers an actionable framework for mathematics instruction that centers on students' mental resilience alongside cognitive skill development.

CONCLUSION

This study analyzed the mathematical problem-solving abilities of fifth-grade elementary students in relation to their Adversity Quotient (AQ) profiles: quitter, camper, and climber. The findings show that climber-type students were able to successfully apply all of Polya's problem-solving stages (understanding the problem, planning the solution, implementing the plan, and checking the results) in a systematic way, and they demonstrated the ability to reflect critically and simplify their answers. Camper-type students exhibited basic procedural competence but were limited in their understanding of the problem context and in evaluating their answers. Meanwhile, quitter-type students tended to fail to fulfill all of Polya's stages, producing unstructured solutions, making conceptual errors (e.g. adding fractions without finding common denominators), and showing no effort to verify their results.

The pattern of errors observed was correlated with the level of AQ. Climber students had minimal errors, likely due to better metacognitive skills and resilience. Camper students committed mostly minor contextual and procedural errors, reflecting partial understanding and inconsistent reflection. Quitter students exhibited fundamental errors at all stages, stemming from a lack of motivation and weak grasp of concepts. Based on these findings, several pedagogical implications can be drawn:

1. Differentiated instruction by AQ profile: For quitter-type students, provide intensive scaffolding through structured guidance, reinforcement of basic math concepts, and gradual practice to build their confidence and persistence.
2. Contextualized learning for campers: For camper-type students, link mathematical problems to real-life situations (e.g., through problem-based learning) to improve their contextual understanding and reduce procedural errors, while offering scaffolded feedback to promote independent reflection.
3. Enrichment and challenge for climbers: For climber-type students, offer enriched materials and complex, open-ended problems that challenge them to utilize analytical and metacognitive skills (such as multi-step problem-solving projects or reflective group discussions) to further deepen their learning.

Implementing these strategies can help tailor the learning experience to students' adversity profiles, thereby potentially enhancing their overall problem-solving competencies. The integration of AQ considerations into mathematics education, as evidenced by this study, underscores the value of addressing not just cognitive skills but also students' resilience and response to challenges. Future research can further explore interventions that effectively improve AQ and examine how these affect students' learning outcomes in mathematics.

REFERENCES

Acosta-Gonzaga, E., & Ramirez-Arellano, A. (2022). Scaffolding Matters? Investigating Its Role in Motivation, Engagement and Learning Achievements in Higher Education. *Sustainability (Switzerland)*, *14*(20). https://doi.org/10.3390/su142013419

Anwar, L., Sa'dijah, C., Murtafiah, W., & Huljannah, M. (2024). Adversity quotient of Indonesian prospective mathematics teachers in solving geometry higher-order thinking skills problems. *Journal on Mathematics Education*, *15*(1), 79–98. https://doi.org/10.22342/jme.v15i1.pp79-98

Apriyani, Y., & Uyun, M. (2023). The Role of Self-Resilience and Self-Efficacy to Increase Adversity Quotient. *Psikoborneo: Jurnal Ilmiah Psikologi*, *11*(2), 162–162. https://doi.org/10.30872/psikoborneo.v11i2.10988

Bakar, M. A. A., & Ismail, N. (2020). Express students' problem solving skills from metacognitive skills perspective on effective mathematics learning. *Universal Journal of Educational Research*, *8*(4), 1404–1412. https://doi.org/10.13189/ujer.2020.080433

Bolstad, O. H. (2023). Lower secondary students' encounters with mathematical literacy. *Mathematics Education Research Journal*, *35*(1), 237–253. https://doi.org/10.1007/s13394-021-00386-7

Chang, I. (2023). Early numeracy and literacy skills and their influences on fourth-grade mathematics achievement: a moderated mediation model. *Large-Scale Assessments in Education*, *11*(1). https://doi.org/10.1186/s40536-023-00168-6

Djatmika, E. T., & Astutik, P. P. (2023). Learning Profile Mapping for Differentiated Instruction Implementation. *International Journal of Humanities, Social Sciences and Education*, *10*(7), 51–56. https://doi.org/10.20431/2349-0381.1007006

Fahrudin, D., Mardiyana, & Pramudya, I. (2019). The analysis of mathematic problem solving ability by polya steps on material trigonometric reviewed from self-regulated learning. *Journal of Physics: Conference Series*, *1254*(1). https://doi.org/10.1088/1742-6596/1254/1/012076

Fauziah, M., Marmoah, S., Murwaningsih, T., & Saddhono, K. (2020). The effect of thinking actively in a social context and creative problem-solving learning models on divergent-thinking skills viewed from adversity quotient. *European Journal of Educational Research*, *9*(2), 537–568. https://doi.org/10.12973/eu-jer.9.2.537

Hakim, F., & Murtafiah, M. (2020). Adversity Quotient and Resilience in Mathematical Proof Problem-Solving Ability. *MaPan: Jurnal Matematika dan Pembelajaran*, *8*(1), 87–87. https://doi.org/10.24252/mapan.2020v8n1a7

Ika Putri Wulandari, R., & Sugianto. (2019). Critical Thinking Ability in terms of Adversity Quotient on DAPIC Problem Solving Learning. *Unnes Journal of Mathematics Education Research*, *8*(1), 2019–2052.

Istiqomah, S. N., Suyitno, H., & Safa'atullah, M. F. (2021). Mathematical problem solving ability of 8th grade students in terms of adversity quotient using discovery learning. *Unnes Journal of Mathematics Education*, *10*(2), 144–154. https://doi.org/10.15294/ujme.v10i2.31699

Juwita, H. R., Roemintoyo, & Usodo, B. (2020). The Role of Adversity Quotient in the Field of Education: A Review of the Literature on Educational Development. *International Journal of Educational Methodology*, *6*(3), 507–515. https://doi.org/10.12973/ijem.6.3.507

Kania, N., Juandi, D., & Fitriyani, D. (2022). Implementasi Teori Pemecahan Masalah Polya dalam Pembelajaran Matematika (Yuhani et al ., 2018). Dalam pembelajaran matematika masalah bukan hanya dalam pembelajaran dan pola pikir kritisnya . Pembelajaran yang diberikan kepada siswa dalam seseorang . M. *Progressive of Cognitive and Ability*, *1*(1), 42–49.

Karan, E., & Brown, L. (2022). Enhancing Student's Problem -solving Skills through Project-based Learning Ebrahim Karan and Lisa Brown *. *Journal of Problem Based Learning in Higher Education*, *10*(1), 74–87. https://doi.org/10.54337/ojs.jpblhe.v10i1.6887

Kusuma, J. W., Hamidah, Mahuda, I., Sukandar, R. S., Santoso, E., & Jatisunda, M. G. (2021). Project-based learning with LMS moodle to promote mathematical problem solving and self-regulated learning. *Journal of Physics: Conference Series*, *1764*(1). https://doi.org/10.1088/1742-6596/1764/1/012135

Mafugu, T. (2024). Influences on Mathematics Achievement in Rural Schools: A Nested Study of Underprivileged Learners. *Interchange*, *56*, 1–15. https://doi.org/10.1007/s10780-024-09533-y

Musna, R. R., Juandi, D., & Jupri, A. (2021). A meta-analysis study of the effect of Problem-Based Learning model on students' mathematical problem solving skills. *Journal of Physics: Conference Series*, *1882*(1). https://doi.org/10.1088/1742-6596/1882/1/012090

Mutaqin, E. J., Asyari, L., Tetep, T., & Hamdani, N. A. (2021). Mathematical learning trajectory in primary school. *Journal of Physics: Conference Series*, *1987*(1). https://doi.org/10.1088/1742-6596/1987/1/012032

Nasution, I. Y. L. U., Mulyono, & Surya, E. (2024). Development of Mathematics Learning Tools Using Problem Based Learning Model to Improve Problem Solving Skills and Learning Motivation. *Jurnal Perspektif*, *8*(2), 250–262. https://doi.org/10.15575/jp.v8i2.306

Niss, M., & Højgaard, T. (2020). Mathematical Competencies Revisited. *Educational Studies in Mathematics*, *102*, 9–28.

Nurkaeti, N. (2018). Polya'S Strategy: an Analysis of Mathematical Problem Solving Difficulty in 5Th Grade Elementary School. *EduHumaniora | Jurnal Pendidikan Dasar Kampus Cibiru*, *10*(2), 140–140. https://doi.org/10.17509/eh.v10i2.10868

Omiralievna, M. B. (2024). Development and Cultivation of Mathematical Literacy: A Pedagogical Perspective. *Eurasian Science Review*, *2*(2), 94–99. https://doi.org/10.63034/esr-55

Ortiz, E. (2016). The Problem-Solving Process in a Mathematics Classroom. *Transformations*, *1*(1), 4–4.

Padliadi, Marwan, & Zubainur, C. M. (2020). The thinking process of quitter students in solving open-ended mathematical problems. *Journal of Physics: Conference Series*, *1460*(1). https://doi.org/10.1088/1742-6596/1460/1/012007

Poçan, S., Altay, B., & Yaşaroğlu, C. (2023). The Effects of Mobile Technology on Learning Performance and Motivation in Mathematics Education. *Education and Information Technologies*, *28*(1), 683–712. https://doi.org/10.1007/s10639-022-11166-6

Polya, G. (1945). *How to Solve It: A New Aspect of Mathematical Method*. Princeton University Press.

Rahmayantri, A., & Priatna, N. (2022). Kemampuan Pemecahan Masalah Matematika Siswa Kelas VII Dalam Menyelesaikan Soal Aritmatika Sosial Berdasarkan Tipe Adversity Quotient. *EduMatSains: Jurnal Pendidikan, Matematika dan Sains*, *7*(1), 197–208.

Rakhmawati, Y., & Mustadi, A. (2022). The circumstances of literacy numeracy skill: Between notion and fact from elementary school students. *Jurnal Prima Edukasia*, *10*(1), 9–18. https://doi.org/10.21831/jpe.v10i1.36427

Rasyid, A., Rinto, R., & Susanti, M. (2023). Project-Based Learning through the STEM Approach in Elementary Schools: How to Improve Problem-Solving Ability. *Journal of Education For Sustainable Innovation*, *1*(1), 1–8. https://doi.org/10.56916/jesi.v1i1.477

Saxena, S., & Rathore, B. (2025). Adversity Quotient as Determining Factor of Mental Health and Professional Quality of Life Among Healthcare Professionals: A Systematic Review. *Annals of Neurosciences*, *31*(1), 58–65. https://doi.org/10.1177/09727531241231055

Siregar, R. N., Suryadi, D., Prabawanto, S., & Mujib, A. (2022). Cognitive Flexibility of Students in Solving Mathematical Problems: A Phenomenology Study. *Kreano: Jurnal Matematika Kreatif-Inovatif*, *13*(2), 354–369.

Smith, K., Maynard, N., Berry, A., Stephenson, T., Spiteri, T., Corrigan, D., Mansfield, J., Ellerton, P., & Smith, T. (2022). Principles of Problem-Based Learning (PBL) in STEM Education: Using Expert Wisdom and Research to Frame Educational Practice. *Education Sciences*, *12*(10). https://doi.org/10.3390/educsci12100728

Stoltz, P. G. (1997). *Adversity quotient: Turning obstacles into opportunities*. John Wiley & Sons.

Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of problem-solving strategies in mathematics education supporting the sustainability of 21st-century skills. *Sustainability (Switzerland)*, *12*(23), 1–28. https://doi.org/10.3390/su122310113

Tanjung, H., Sinaga, B., & Mansyur, A. (2021). Analysis of Student's Spatial Ability in terms of Van Hiele's Thinking Stages in Problem Based Learning. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, *4*(1), 470–485. https://doi.org/10.33258/birle.v4i1.1675

Yuniara, R., Saminan, S., Abidin, Z., & Johar, R. (2023). Students' Mathematical Problem Solving Ability Based on The Steps of Ideal Problem Solving Viewed From Adversity Quotient (AQ). *Al Khawarizmi: Jurnal Pendidikan dan Pembelajaran Matematika*, *7*(1), 36–36. https://doi.org/10.22373/jppm.v7i1.18211

Yustiana, Y., Kusmayadi, T. A., & Fitriana, L. (2021). Mathematical problem solving ability of vocational high school students based on adversity quotient. *Journal of Physics: Conference Series*, *1806*(1). https://doi.org/10.1088/1742-6596/1806/1/012092

This page is intentionally left blank