

Students' mathematical problem-solving process on proportion topic viewed from adversity quotient

Diana Novitasari*, Lathiful Anwar, Vita Kusumasari

Universitas Negeri Malang, Jl. Semarang No.5 Kota Malang, Jawa Timur, Indonesia

*Corresponding author.

Email: diana.novitasari.2303118@students.um.ac.id

Abstract

Mathematical problem solving is a person's effort in applying knowledge, understanding, and using certain strategies to determine the solution of a mathematical problems. Polya's steps in problem solving are understanding the problem, devising a plan, carrying out the plan, and looking back. A person's ability to solve a problem is strongly influenced by Adversity Quotient (AQ). AQ is the ability to endure problems, so AQ is used as a measure of a person in solving the problems. The purpose of this research is to describe students' mathematical problem solving process on the topic of proportion in terms of Adversity Quotient (AQ). The type of research used is descriptive qualitative research. This research was conducted in a junior high school by giving the Adversity Response Profile (ARP) questionnaire and one proportion problem to 22 students. 5 out of 22 students who are Climber, Camper, and Quitter were selected as research subjects. The findings in this research are that Climber students have good problem solving skills because they fulfill 3 Polya steps. Camper students have sufficient problem solving skills because they fulfill 2 Polya steps. While Quitter students have low problem solving skills because none of Polya's steps are met.

Keywords: *adversity quotient, Polya, problem solving, proportion*

Submitted November 2024, Revised March 2025, Published April 2025

How to cite: Novitasari, D., Anwar, L., & Kusumasari, V. (2025). Students' mathematical problem-solving process on proportion topic viewed from adversity quotient. *Jurnal Kajian Pembelajaran Matematika*, 9(1), 11-17.

INTRODUCTION

The independent curriculum era is a new era in education in Indonesia that not only produces students who are able to memorize, but also can produce quality educational output. The output is shown in terms of sharp analysis, understanding, and reasoning processes in learning (Nurulaeni & Rahma, 2022). Through independent learning, students are expected to be able to solve math problems related to everyday life.

There are various approaches that can be applied to solve math problems, one of which is Polya's approach. According to Polya (2004), problem solving consists of four steps, namely understanding a problem, devising a plan, carrying out the plan, and looking back. The application of Polya's steps provides many advantages, namely students become active in improving their thinking skills in solving problems (Mitasari & Murtiyasa, 2023).

Before conducting the research, the researcher conducted a preliminary study in one of the junior high schools in Kediri. Students were asked to solve one math problem on the topic of proportion. From the results of the preliminary study, it can be concluded that students' understanding of the problems given is quite good, but there are still students who do not understand the problem or still do not understand the concept of proportion. This resulted in the implementation of the solution plan and the results obtained being less precise. Therefore, students' problem-solving skills need to be trained so that students can solve existing problems (Febrianti et al., 2022).

Students' abilities in solving math problems are very diverse. This is based on strong motivation from students. Motivation or desire is very influential in the success of solving math problems because it requires an attitude of being able to survive in solving these problems (Giawa et al., 2024). Adversity Quotient (AQ) is a person's ability to survive and overcome difficulties/problems (Stoltz, 2003). According to Hakim (2020), Adversity Quotient has a significant effect on problem solving ability. There is a complex and interconnected relationship between Adversity Quotient (AQ) and mathematics, which has been extensively investigated in numerous studies (Anwar et al., 2024). Therefore, the existence of Adversity Quotient (AQ) can be used as an indicator to determine the extent of students' ability to solve math problems. Based on the description above, the researcher wants to know the process of students' mathematical problem-solving ability on the topic of proportion in terms of Adversity Quotient (AQ).

METHOD

This research uses descriptive qualitative research which aims to describe the students' mathematical problem-solving process on the topic of proportion in terms of Adversity Quotient (AQ). This research was conducted in a junior high school by giving the Adversity Response Profile (ARP) questionnaire and one proportion problem to 22 students.

Selection of research subjects based on: (1) completeness of answers based on Polya's steps, (2) students' communication skills, and (3) students' willingness to become research subjects. Then three students were selected as research subjects consisting of one Climber student, one Camper student, and one Quitter student. The selected subjects symbolized Cl as climber student, Cp as camper student, and Qt as quitter student. The data collection techniques in this study were mathematical problem tests and interviews. The instruments used in this study, namely the researcher as the main instrument, Adversity Response Profile (ARP) questionnaire, proportion mathematical problem test, and interview guidelines.

RESULTS AND DISCUSSION

The ARP questionnaire data that has been analysed can be found grouping of each AQ category which can be seen in Table 1.

Table 1 Adversity Quotient (AQ) Categories of Students of VIII D Class

AQ Category	Quitter	Camper	Climber
Many students	5	14	3
Percentage	22,73%	63,64%	13,63%

Based on Table 1, it is obtained that in class VIII-D Camper students are more dominant than other categories.

Then all students were given one mathematical problem on the topic of proportion and one subject from each category was selected based on the 3 criteria previously described. The selection of subjects in this study can be seen in Table 2.

Table 2 Research Subjects

Initials	Subject Code	AQ Score	AQ Category
RWW	Cb	173	Climber
AFM	Cp	133	Camper
ARS	Qt	58	Quitter

Furthermore, interviews were conducted with the research subjects to inform and explore information based on their written data.

Analysis of students' mathematical problem-solving process on the topic of proportion from the problem-solving test results and interview results based on Polya's problem solving steps, namely understanding a problem, devising a plan, carrying out the plan, and looking back. The following is a discussion of each research subject for each of these indicators.

1. Mathematical problem solving of Climber subject (Cb)

The answers of Climber subject (Cb) in solving problems are presented in Figure 1.

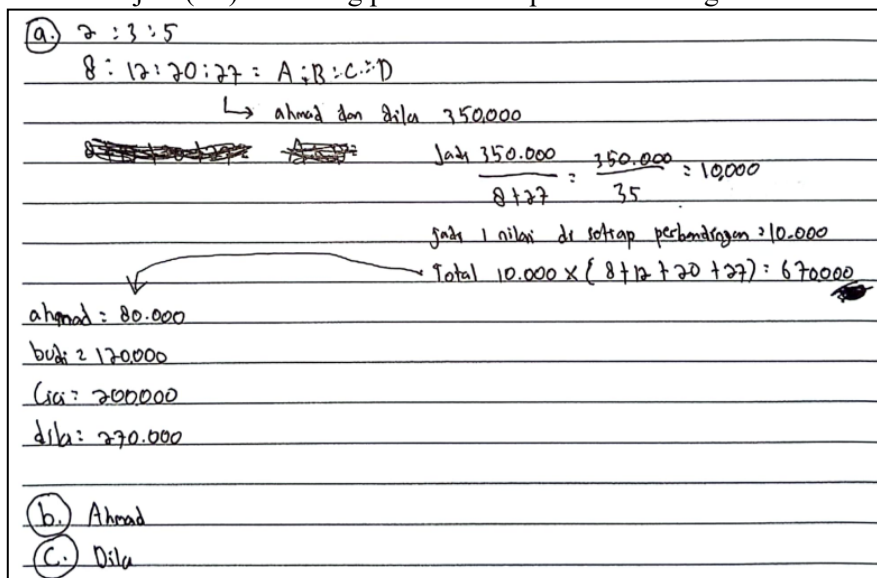


Figure 1 Cb's Answer

At the step of understanding the problem, Cb was able to identify the problem well. Cb was able to write down the known information in the problem and could identify the problem to be solved using their own language appropriately. The following is the transcript of the interview with Cb to confirm and explore information about his understanding of the problem given.

- P : What is known and asked about the problem?
 Cb : What is known is the ratio of Ahmad, Budi, Cici's money, the ratio of Budi, Cici, Dila's money, and the sum of Ahmad and Dila's money, ma'am.
 P : How can you write that what is known in the problem: Ratio A, B, C = 2: 3 : 5 ; Ratio B, C, D = 12 : 20 : 27 ; Total money of A and D = 350.000
 Cb : In the question, the ratio is known, ma'am.
 P : What do you mean by A, B, C, D that you wrote in the known aspect?
 Cb : That's what I generalized ma'am. A for Ahmad's money, B Budi, C Cici, D Dila.

At the step of devising a problem-solving plan, Cb was able to show the relationship between their understanding and knowledge. Cb was able to develop a solution plan effectively using mathematical concepts/formulas related to the problem. The following is the transcript of the interview with Cb to confirm and explore information about the solution plan to the problem given.

- P : Before you work, do you have an idea to solve the problem? If yes, try to explain the strategy you use.
 Cb : I made the A, B, C, D memorization that I explained earlier, ma'am. Then because in the problem, the ratio of A, B, C and the ratio of B, C, D are known, so I determined the ratio of the four first so I could do it.
 P : How did you determine the ratio of the amount of money of the four people?
 Cb : The first ratio is A:B:C is 2:3:5, the second ratio is B:C:D is 12:20:27. Now there is the same thing ma'am, so I compared it. B in the second ratio is 4 times B in the first ratio. C is also like that ma'am. So I thought that A in the second ratio is automatically 4 times the first ratio. So later I found A : B : C : D = 8 : 12 : 20 : 27.

At the step of carrying out the problem-solving plan, Cb wrote the problem-solving steps systematically and precisely according to the plan they had made before. In this process, Cb applied the mathematical concepts of ratio and proportion and used their numeracy skills to obtain the final result as they had found. The following is the transcript of the interview with Cb to confirm and explore information about the solution to the problem given.

- P : Try to explain the sequence of solution steps that you have written on your answer
 Cb : I have found the ratio of the four people, ma'am. In the problem, it is known that Ahmad and Dila have 350.000, while in the ratio of the four people Ahmad is 8 and Dila is 27. I just divide $350000/(8+27)=350000/35=10000$. So, 1 value in the proportion is 10.000. Then I found Ahmad's money 80,000, Budi's money 120.000, Cici's money 200.000, and Dila's money 270.000. The one who gets the least money is Ahmad, the most is Dila.

At the looking back step, Cb rechecked the strategies and results they had found at the previous step. However, Cb forgot to write the unit in the final result of his work. The following is the transcript of the interview with Cb to confirm and explore information about rechecking the answer to the solution of the problem given.

- P : The solution that you found, which is a lot of money Ahmad 80.000, a lot of money Budi 120.000, a lot of money Cici 200.000, a lot of money Dila 270.000. How do you check the correctness of the solution you got?
 Cb : I checked because the total of the four is 670.000 so I tried to add up the money of Ahmad, Budi, Cici, Dila. I got the same 670.000.
 P : After you finish working, are you sure that the answer you found is correct?
 Cb : Sure ma'am, because I have also checked on the scribble paper that it is correct. If I add Ahmad and Dila's money, the result is 350.000, just like in the question.
 P : Did you write down the unit of money that each person earned?
 Cb : I forgot ma'am, I didn't write Rupiah.

2. Mathematical problem solving of Camper subject (Cp)

The answers of Camper subject (Cp) in solving problems are presented in Figure 2.

Diketahui : Rasio atas
Ahmad Budi Cici
2 3 5
Rasio bawah Budi Cici Dila
12 20 27
Ditanya = a. Banyak uang
b. Paling sedikit
c. Paling banyak
Dijawab: a.) Mencuri x
$A + Dx = 350$
$A = 12 : 3 = 4$
$A + 27 = 35x = 350$
$x = 10$
$A = 8 \cdot 10 = 80 \cdot 000$
$B = 12 \cdot 10 = 120 \cdot 000$
$C = 20 \cdot 10 = 200 \cdot 000$
$D = 27 \cdot 10 = 270 \cdot 000$
b.) Paling sedikit = $A = 80.000 = Ahmad$.
c.) Paling banyak = $D = 270.000 = Dila$

Figure 2 Cp's Answer

At the step of understanding the problem, Cp was able to identify the problem well. Cp was able to write down the known information in the problem and could identify the problem to be solved using their own language. The following is the transcript of the interview with Cp to confirm and explore information about his understanding of the problem given.

- P : What is known and asked about the problem?
 Cp : That's Mom, the first ratio is Ahmad, Budi, and Cici 2: 3: 5. The second ratio Budi, Cici, and Dila 12: 20: 27. Find the amount of money each, the least money, and the most money.
 P : How can you write down what is known and asked in such a problem?
 Cp : There are 2 kinds of ratios in the problem, so I wrote them all down.

At the step of devising a problem-solving plan, Cp was able to develop a solution plan effectively using mathematical concepts/formulas related to the problem. Cp determined the value of x as the multiplying factor of the ratio and determined the value of ratio A using the concept of valued proportion. The following is the transcript of the interview with Cp to confirm and explore information about the solution plan to the problem given.

- P : Before you work, do you have an idea to solve the problem? If yes, try to explain the strategy you use.
 Cp : Looking for the x value first ma'am. Ahmad + Dila is 350.000. So, I wrote $A + Dx = 350$. But because I don't know A yet, I looked for it first. Budi's lower ratio is 12, while Budi's upper ratio is 3, so I immediately divide the result by 4.
 So, A will be $8 + 27 = 35$.
 P : In this part, $A + 27$ why can you get the result to be $35x$? Not just 35?
 Cp : It's $A + Dx = 350$ ma'am
 P : Is A alone or is Ax correct?
 Cp : Yes, Ax should be.
 P : Okay, then it should be $8 + 27$ or something like that?
 Cp : $8x + 27x$ ma'am.
 P : Then does that mean Ahmad and Dila's total money is 350 thousand or only 350?
 Cp : 350 thousand ma'am. I haven't written it completely.

At the step of carrying out the problem-solving plan, Cp wrote down the problem-solving steps according to what they had planned. However, Cp was wrong in modeling the problem into a mathematical sentence, so they did not realize that there was an error in the calculation, even though the final answer they got was correct. The following is the transcript of the interview with Cp to confirm and explore information about the solution to the problem given.

- P : Try to explain the sequence of solution steps that you have written on your answer

- Cp : The amount of Ahmad and Dila's money was 350.000 ma'am. Obtained $35x = 350$ thousand. I didn't write the thousand behind 350 ma'am. So, the value of $x = 10$ thousand, ma'am that's what I meant. I wrote it wrong again.
- P : Okay good if you already know your mistake. Next, how do you determine the money earned by each person?
- Cp : $A = 8 \times 10$ thousand = 80.000, $B = 12 \times 10$ thousand = 120.000, $C = 20 \times 10$ thousand = 200.000, $D = 27 \times 10$ thousand = 270.000. The 10 is 10 thousand
- P : Okay, then which one earns the least and the most money?
- Cp : The least is Ahmad 80.000, the most is Dila Rp 270.000.

At the step of looking back the answers obtained, Cp did not re-examine the answers he obtained in writing. Therefore, the researcher conducted an interview with Cp to explore information about re-examining the answer to the solution of the problem given.

- P : The solution you found, namely a lot of money Ahmad 80.000, a lot of money Budi 120.000, a lot of money Cici 200.000, a lot of money Dila 270.000. How do you check the correctness of the solution you got?
- Cp : I don't know, ma'am.
- P : Have you written down the unit of money that each person gets?
- Cp : No ma'am, I should have put Rp in front of the number ma'am.
- P : How should it be?
- Cp : Ahmad Rp 80.000, Budi Rp 120.000, Cici Rp 200.000, and Dila Rp 270.000.

Based on the results of the interview with Cp, it was found that Cp did not check the answers she obtained so that Cp did not realize that the solution she wrote down was wrong, 35 thousand should be 35 and 10 thousand should be 10 only. Cp also only had 1 solution to the problem.

3. Mathematical problem solving of Quitter subject (Qt)

The answers of Quitter (Qt) subjects in solving problems are presented in Figure 3.

a. Diket: Ahmad, Budi dan Cici 2:3:5
 Budi, Cici dan Dila 12:20:27
 Ahmad dan Dila = Rp 350.000,00
 Ditanya: Uang masing masing anak
 Jawab:
 $Budi, Cici, Dila = 12:20:27 = Ahmad? = 12+20+27 = 59$
 $= 100 - 59 = 41$
 $= Budi, Cici, Dila, Ahmad = 12 \times 41, 20 \times 41, 27 \times 41$
 $Ahmad Dila = 350.000,00$

b. Budi Jawab. a. $2 \times 41 = 82 \rightarrow 101.000$
 c. Cici b. $3 \times 41 = 123 \rightarrow 241.000$
 c. $5 \times 41 = 205 \rightarrow 305.000$
 d. $\rightarrow = 27 \times 41 = 1107.000$

Figure 3 Qt's Answer

At the step of understanding the problem, Qt was less able to identify the problem well. Qt wrote down the known information in the problem but could not identify the problem to be solved using their own language. The following is the transcript of the interview with Qt to confirm and explore information about his understanding of the given problem.

- P : What is known and asked about the problem?
- Qt : The ratio of Ahmad, Budi, and Cici 2: 3: 5. Budi, Cici, and Dila 12: 20: 27. Ahmad and Dila's money is 350.000 rupiah. Find the money of each child.
- P : Is what is asked in the problem only the amount of money from each child?
- Qt : No ma'am, we are looking for the smallest and the most money too.

At the step of devising a problem-solving plan, Qt was less precise in developing a solution plan. This is because Qt is less precise in applying mathematical concepts/formulas, so the planning is wrong. The

following is the transcript of the interview with Qt to inform and explore information about the solution plan to the problem given.

- P : Before you work, do you have an idea to solve the problem? If yes, try to explain the strategy you use.
- Qt : There is only the ratio of Budi, Cici, Dila ma'am, 12: 20: 27. But Ahmad doesn't exist yet.
- P : How did you determine the ratio of Ahmad?
- Qt : Budi, Cici, Dila are 12: 20: 27, so if you add them up, the result is 59. Then if the total is 100, the rest of Ahmad is 41. So Budi, Cici, Dila, Ahmad = 12, 20, 27, 41.
- P : How did you get the total of 100 to determine Ahmad's money?
- Qt : The total is 100% ma'am.

At the step of carrying out the problem-solving plan, Qt was wrong in writing the solution steps. Qt was wrong in determining the problem-solving plan so that it made him wrong in his calculations. The following is the transcript of the interview with Qt to inform and explore information about the solution to the problem given.

- P : Try to explain the sequence of solution steps that you have written on your answer
- Qt : I multiply by 4 ma'am. So later we get $a = 8$, $b = 12$, $c = 20$, $d = 27$.
- P : After you multiply 4, you get $a = 8$, $b = 12$, $c = 20$, $d = 27$. So then in your work why does $a = 8$ become 14.000, $b = 12$ become 24.000, $c = 20$ become 30.000, and $d = 27$ become 150.000?
- Qt : I don't know mom, I'm not sure.

At the step of looking back the answers obtained, Qt did not re-examine the answers he obtained in writing. Therefore, the researcher conducted an interview with Qt to explore information about re-examining the answer to the solution of the problem given.

- P : The solution you found, namely a lot of money Ahmad 14.000 a lot of money Budi 24.000, a lot of money Cici 30.000, a lot of money Dila 150.000. How do you check the correctness of the solution you got?
- Qt : I didn't check ma'am, because I didn't understand the problem.
- P : After you finish working, are you sure that the answer you found is correct?
- Qt : I'm not sure, ma'am.

In general, the students' problem solving in terms of Adversity Quotient is described in Table 3.

Table 3 Students' Problem Solving in Terms of Adversity Quotient

Subject Code	AQ Category	P1	P2	P3	P4
Cb	Climber	V	V	V	X
Cp	Camper	V	V	X	X
Qt	Quitter	X	X	X	X

The findings in this study explain that Climber category students have good abilities in solving the problems given, where Climber category students can understand the problem, devising a plan, and carrying out the problem. Even though Climber students have rechecked the answers they get, Climber students forget to write units in the results. This makes the answers of Climber students incomplete. This is in line with the results of research by Hutami et al. (2020) that Climber students fulfill the three steps of Polya's problem solving, and Climber students do not write conclusions and units in their answers.

Furthermore, the second finding is that Camper category students are found to have sufficient ability in solving the problems given, where Climber category students can understand the problem and devising a plan. At the step of carrying out the plan, Camper students have used their numeracy skills and knowledge, but Camper students are incomplete in their calculations. In addition, Camper students also do not recheck their answers, so they do not know if there are errors in their calculations. The results of this study are in line with the research of (Hutami et al., 2020; Muhtarom et al., 2023) that Camper students only fulfill two steps of Polya's problem solving, because Camper students experience calculation errors and do not recheck the results of their answers.

The third finding is that students in the Quitter category have a lack of ability in solving problems, where they are less able to understand the problem and cannot make a solution plan. Students of this category solve problems without using previous plans and do not recheck the results they have obtained. The results of this study reinforce previous findings that students with the Quitter category do not fulfill the four steps of Polya's problem solving (Hofifah et al., 2023; Muhtarom et al., 2023; Rusani & Fetria Trisnawati, 2021).

Apart from the virtues of the research results that have been described, the limitations of the study are also reported that the subject of this study only took one class in one school. In addition, the Adversity Response Profile (ARP) questionnaire to classify students according to the AQ category was adopted directly from previous research. Therefore, further research is expected to develop the instrument independently and involve research subjects from various schools and various regions so that the subjects studied are more heterogeneous.

CONCLUSION

Based on the research results supported by several theories and the results of previous studies, so that the mathematical problem-solving process on the topic of proportion in terms of Adversity Quotient (AQ) is concluded that Climber category students have a good ability to solve problems by fulfilling three indicators namely understanding, devising a plan, and carrying out the plan. Camper category students were found to have sufficient problem-solving ability because they were able to fulfill two indicators, namely understanding and planning problem solving. Meanwhile, students in the Quitter category were found to have poor problem-solving skills because they did not fulfill all Polya's problem solving indicators.

Therefore, for improvement and follow-up process, it is recommended to the teacher to give problems in the form of problem-solving, so that students are accustomed to solving such problems. Furthermore, it is recommended for teachers to conduct ARP tests to their students, because with the AQ grouping, teachers can apply learning strategies or methods that are in accordance with the characteristics of the AQ category and can increase student interest/motivation. As for future research, it is recommended to study how to apply strategies that can improve students' problem-solving skills based on the classification of their AQ category.

REFERENCES

- 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>
- Febrianti, T., Zakiah, N. E., & Ruswana, A. M. (2022). Profil kemampuan pemecahan masalah matematis siswa smp pada materi lingkaran ditinjau dari adversity quotient (AQ). *Jurnal Keguruan Dan Ilmu Pendidikan, 3*(2), 420–427.
- Giawa, S., Pangaribuan, F., & Tambunan, H. (2024). Analisis hubungan motivasi belajar dengan kemampuan pemecahan masalah siswa kelas XII pada materi sistem persamaan linear dua variabel di SMK Negeri 1 Boronadu. *Journal on Education, 06*(03).
- Hakim, F. (2020). Faktor Adversity Quotient dalam Kemampuan Pemecahan Masalah Pembuktian Matematis Topik Teori Grup. *Indonesian Journal of Educational Science (IJES), 2*(2), 90–98.
- Hofifah, F., Styo Siskawati, F., Novita Irawati, T., & Islam Jember, U. (2023). Analisis kemampuan pemecahan masalah matematis siswa SMK ditinjau dari adversity quotient. *Jurnal Edumath, 9*(1), 40–46.
- Hutami, F. E., Trapsilasiwi, D., & Murtikusuma, R. P. (2020). Analisis kesalahan siswa dalam menyelesaikan soal program linear ditinjau dari adversity quotient. *Alifmatika: Jurnal Pendidikan Dan Pembelajaran Matematika, 2*(1), 1–13. <https://doi.org/10.35316/alifmatika.2020.v2i1.1-13>
- Mitasari, D., & Murtiyasa, B. (2023). Analisis kemampuan pemecahan masalah matematis siswa dalam menyelesaikan soal cerita pada materi aritmatika sosial berdasarkan langkah Polya. *Jurnal Cendekia : Jurnal Pendidikan Matematika, 7*(2), 1759–1772. <https://doi.org/10.31004/cendekia.v7i2.2399>
- Muhtarom, Putri Sholihah, E., & Sutrisno. (2023). Analisis kemampuan pemecahan masalah matematis siswa pada materi bilangan bulat ditinjau dari adversity quotient. *Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika, 4*(2), 1258–1273. <https://doi.org/10.46306/lb.v4i2>
- Nurulaeni, F., & Rahma, A. (2022). Analisis problematika pelaksanaan merdeka belajar matematika. *Jurnal Pacu Pendidikan Dasar, 2*(1), 2807–1107. <https://unu-ntb.e-journal.id/pacu>
- Polya, G. (2004). *How to solve it: A new aspect of mathematical method*. Princeton University Press.
- Rusani, I., & Fetria Trisnawati, N. (2021). Analisis kemampuan pemecahan masalah matematika siswa menggunakan langkah-langkah polya di tinjau dari adversity quotient tipe campers dan tipe quitters. *AdMathEdu: Jurnal Ilmiah Pendidikan Matematika, Ilmu Matematika Dan Matematika Terapan, 11*(1), 73–86.
- Stoltz, P. G. (2003). *Adversity quotient: Mengubah hambatan menjadi peluang* (T. Alih Bahasa: Hermata, Ed.). Gramedia Widiasarana Indonesia (Grasindo).