e-ISSN: 2549-5070
p-ISSN: 2549-8231

Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang
Volume 7, No. 1, 2023, pp. 106 - 116

https://doi.org/10.31331/medivesveteran.v7i1.2330

Profile Of Students' Argumentation Ability Based On Adversity Quotient In Statistical Problem

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Received: *November 2022.* ***Accepted***: *December 2022.* ***Published***: *January 2023.*

ABSTRACT

Argumentative ability can be seen from the argumentation pattern that appears. This pattern needs to be evaluated to look over the quality of the argumentation to make the right problem-solving. This evaluation can be done by recognizing the components that make up the argument. This study goals to describe students' argumentation abilities in solving statistical problem based on Adversity Quotients (AQ). This qualitative descriptive research elaborated 39 students taking a statistical methods course. Subjects were grouped into three types of Adversity Quotient based on the ARP (Adversity Response Profile) questionnaire results. Data were obtained using statistical problem tests and interviews. The outcomes showed three levels of AQ found in students, namely Camper, Toward Climber, and Climber. Camper-type students bring up the Claim-Data-Warrant pattern. Students with AQ levels towards climbers tend to have the same pattern as the Camper type. In comparison, students with the AQ Climber type have a Claim-Data-Warrants-Backing pattern. Based on the outcomes of the study, it can see that students' argumentation skills are determined by the Adversity Quotient level they have when solving statistical problems. The discussions about how to improve the quality of argumentation can be the subject of further research in the future

Keywords: *argumentative ability, adversity quotient, statistical problem*

How to Cite: Putra, Z., Rahardi, R., Sisworo, S., & Permadi, H. (2023). Profile of Students' Argumentation Ability Based On Adversity Quotient In Statistical Problem. *Journal Of Medives : Journal Of Mathematics Education IKIP Veteran Semarang, 7*(1), 106 - 116.

INTRODUCTION

The development of education always follows the changing times and needs. The rapid growth and complexity of today's problems require parallel skills, known as 21st-century skills (Kim et al., 2019). The development of the 21st century has given rise to the skills needed by students, namely communication skills, collaboration, complex thinking, and creativity (Soulé & Warrick, 2015). 21st-century skills in schools can be developed through appropriate learning, namely student centered learning. Several learnings that can develop these skills include game-based, project-based, problem-based, and argument-based learning (Redhana, 2019). Argumentative ability is crucial learning mathematics. This is because one of the indicators that students understand a mathematical concept is that students can develop and evaluate mathematical arguments and evidence (NCTM, 2000). Argumentation demonstrates the ability to express reasons logically, accompanied by adequate data and theoretical support both in oral and written form (Soekisno, 2015). As Toulmin explains, argumentation involves a combination of claims, data, warrants, rebuttals, qualifications, and backing (Conner et al., 2014).

Statistics is one of the materials in mathematics that requires the integration of argumentation skills in learning. This is because learning statistics has the following competencies: (1) understanding the importance of data and the basic concepts of statistics; (2) collecting and describing data; (3) interpreting; and (4) communication of results (Chick & Pierce, 2012; Setiawan & Sukoco, 2021). Statistics is also a material taught from high school to university. In the secondary school curriculum in Indonesia, statistics are integrated into mathematics, focusing on the concepts of collecting, processing, and interpreting observed data. At the higher education level, statistics stands alone, thus confirming that statistics has an a vital role in life, which is not only limited to theory but directly used in the final project research.

The ability to overcome difficulties is one factor that influences a person's way of thinking when solving problems. This statement is based on the results of research conducted by (Khumairoh et al., 2020; Sukmaningrum & Kurniasari, 2022), which found that the ability to overcome difficulties can affect a person's reasoning process. Various factors influence students' argumentative abilities in dealing with problems. However, according to (Stoltz, 2000)there is one factor that has a major influence on a person's success, namely intelligence in overcoming issues which are known as the Adversity Quotient (AQ). According to him, a person's success living life is determined by the level of AQ he has. Furthermore (Hastuti et al., 2018) explained that AQ is a person's ability to survive in encountering difficulties and his efforts to solve problems. Therefore, AQ has the potential to help students strengthen their abilities and resilience in dealing with a problem they have.

The adversity quotient (AQ) level is classified into three categories:

climbers, campers, and quitters (Abdiyani et al., 2019). People with the climber's type tend to choose to keep fighting and don't give up easily in the face of various kinds of problems, so the results obtained are better than people of the campers type (Septianingtyas & Jusra, 2020). People with the campers type tend to be easily satisfied with what has been achieved, so the results are not optimal. Meanwhile, people with the quitter's type tend not to be enthusiastic about solving a problem and even give up before trying, so the results obtained are also unpredictable (Kartikaningtyas et al., 2018). From the description above, it can conclude that the Adversity Quotient is an ability that a person has to observe difficulties and processing them with their intelligence so that they become a challenge to be solved.

Much research has been carried out regarding exploring one's arguments in the field of mathematics (Conner et al., 2014; Indrawati & Febrilia, 2019; Pramesti & Rosyidi, 2020). However, previous research was minimal, which raised statistical material in assessing argumentation abilities and further examined the significance of differences in argumentation abilities based on students' adversity quotients. Based on the description above, this study goals to describe the argumentation abilities of prospective teacher students based on their adversity quotient in statistical problem.

METHOD

This research is a qualitative descriptive study with the aim of obtaining an overview of students' mathematical arguments based on their adversity quotient in statistics material in the form of a case study. The subjects of this study were 39 students of the Mathematics Education Study Program at Malang state university who took methods of statistics lesson. Selection of subjects using sampling with maximum variation, namely looking for samples of cases or individuals with differences in characteristics or traits (Moleong, 2009).

The differences referred to in this study are based on the diversity and correctness of the methods used by students based on the level of adversity quotient they have, namely the types of climbers, campers, and quitters. The instruments in this study were 1) an argumentation test on statistical material in the amount of one question adopted from (Riki Andriatna & Kurniawati, 2021). This question contains a *critical question*, where according to (Gal, 2005)this aspect can emphasize a person's ability to criticize statistical information related to data and arguments. 2) AQ questionnaire that measures the level of AQ found in students. The questionnaire was adopted from (D. F. Hidayat, 2020)The instrument adopted from previous research has been tested for validity and reliability, so repeated tests for this component are no longer needed.

Figure 1. Statistical Problem Test

Table 1. AQ Categorization Based on (Z. R. A. Putra & Oktaviane, 2022)

No	***Adversity Response Profile* Score**	***Adversity Quotient* category**
1	69-80	*Climbers*
2	44-55	*Campers*
3	20-31	*Quitters*

Then, for analyzing argumentation abilities in this study, it refers to the Toulmin argumentation model, as shown in Figure 2 (Conner et al., 2014), which is as follows.

a. Identifying claims by recording statements in the written test as well as the results of subject interviews.
b. Look for possible data to support each claim.
c. Look for warrants that show how the data relate to a particular claim. If no warrant can be identified, the claim is not part of the research because it is not considered an argument.
d. Looking for possible backing for the warrants
e. Interpret the possible elements of an argument and write a reconstructed argument like the following image.

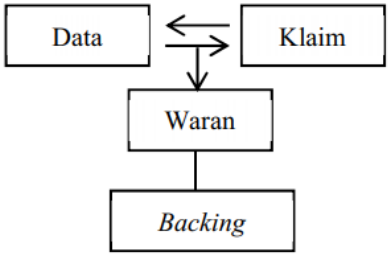

Figure 2. Toulmin's Argumentation Model

Data analysis technique refers to (Miles, M. B., Huberman, A. M., & Saldaña, 2018), which contains data reduction, data presentation, and conclusion and verification. At the data reduction stage, the authors make reductions to getting the right data or information to conclude. At stage data presentation, the author analyzes the data or information obtained from the first stage to present it in a table or other so that the writer can describe the data accurately brought. The last stage is the conclusion to look for meaning and explanation. The validity of the data is done by triangulation theory.

RESULT AND DISCUSSION

Adversity Response Profile (ARP) Analysis

The table below shows the selected subjects based on the results of the *Adversity Response Profile* (ARP) questionnaire:

Table 2 Selected Subjects Based on ARP Results

No	Subject Code	ARP Score	AQ Category	Code
1	PAP	53	Campers	S-Ca
2	AAJ	60	Toward Climbers	S-MC
3	LAS	73	Climbers	S-Cl

Analysis of the Argumentative Ability of Prospective Teacher Students in the AQ *Campers* (S-Ca) Category

The claim (in this case, the answer to the problem) made by the subject of the PAP, namely the statement of the DPS director, is invalid. The claim is shown in Figure 3 below.

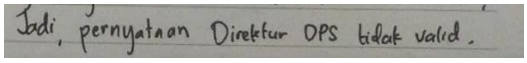

Figure 3. Claims of PAP Subjects

Based on the results of the PAP subject's written test, data was obtained to support the claim: the percentage of accidents each year and statements from the DPS director. Figure 4 below is the data used by the PAP.

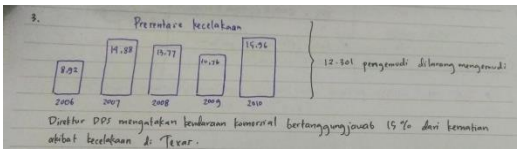

Figure 4 PAP Subject Data

While PAP uses warrants as a bridge between data and claims in the form of an average data concept. Figure 5 shows the written result of the PAP subject showing the warrant.

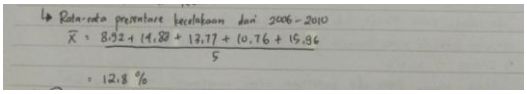

Figure 5 Warrants of PAP Subjects

To clarify the written results of the PAP subject, the following interviews were conducted.

Researcher: "Try to briefly explain your steps in responding to the DPS Director's statement!"
S-Ca: " So it's like this, first I first record the information contained in the problem. It is known that the problem shows a bar chart of the percentage of accidents in 5 years, as well as the DPS director's statement that 15% of the percentage of accidents that occur. After that I calculated the average percentage that occurred in 5 years, and got a result of 12.8%. From the results of my calculations and the director's statement it's not the same. So I can conclude that the DPS director's statement is invalid."

Based on the written results and interviews, initially, the PAP subject collected existing information on the problems given. The details of the data are rewritten in the arguments presented. After getting the current information, PAP calculates the average of the existing data. After obtaining the average, the PAP subject compares the computed results with the statements in the problem. It was found that there was a discrepancy between the calculation results and the information given. Therefore the subject of the PAP submitting a claim for the distinction was that the DPS director's statement was invalid.

Based on Toulmin's model, the following summarizes the arguments for the subject of PAP.

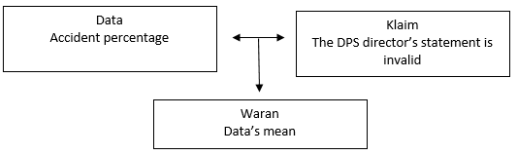

Figure 6 Summary of DPS Subject Arguments

The chart above shows the argumentation patterns of students with AQ-level campers. This is in line with research (Aaidati et al., 2022)where students in the camper category have patterns of claims, data, and warrants arguments. In solving problems students do not fully pay attention to any information contained in the problem, and do not fully use the concepts and knowledge they have before. This is in accordance with what is stated (R. P. Putra et al., 2022; Stoltz, 2000), explained that someone with AQ campers category will try to face challenges but only up to a certain level then stop when they are satisfied enough whit what they have got even though it is not optimal.

Analysis of the Argumentative Ability of Prospective Teacher Students in the AQ Category Towards Climbers (S-MC)

The following are the results of the AAJ subject's mathematical argument analysis. AAJ's subject claim (in this case, the answer to the given problem) is regarding the statement given by the DPS director. The claim is shown in Figure 7 below.

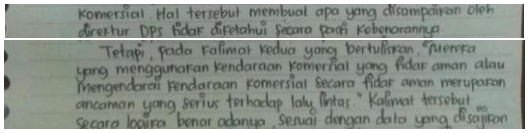

Figure 7 AAJ Subject Claims

There are two claims given, because in the arguments given the AAJ subject examined the DPS director gave two statements.

The data in the question support AAJ's claim. Here the subject only mentions the data without rewriting it.

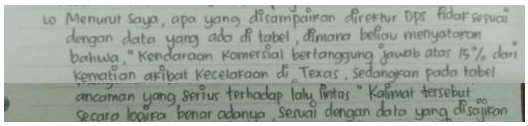

Figure 8 AAJ Subject Data

Meanwhile, the warrant used by the AAJ subject was a comparison of the compatibility between the statements given by the director of DPS and the data in the problems given. For the first statement, the subject assumes that there is a contradiction and for the second statement there is compatibility.

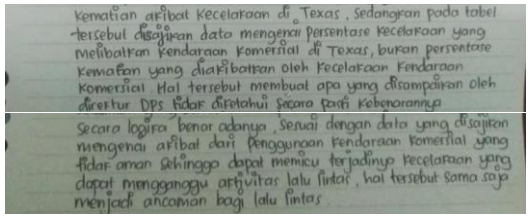

Figure 9 AAJ Subject Warrants

The following interviews were conducted to confirm the AAJ subject's written results.

Researcher: "Do you give 2 conclusions in this case? Try to explain the strategy you used in responding to the DPS Director's statement!"

S-MC : " Yes, the reason I answered that way is because I referred to the data in the question, namely the percentage of accidents in 5 years and the DPS director's statement. I separated the DPS director's statement into two, namely:
1. Commercial vehicles are responsible for about 15% of accidental deaths in Texas.
- From that statement, if I refer to the data, the statement will be false because it does not match the data or there is no correlation where the data shows the percentage of accidents involving commercial vehicles in Texas. Meanwhile, the statement from the DPS director of commercial vehicles is responsible for deaths due to accidents.
2. Those who use unsafe commercial vehicles or drive commercial vehicles unsafely pose a serious threat to traffic.
- From this statement, I conclude that the statement is true because the statement can be the cause of accidents involving commercial vehicles which logically fits the data because the statements above are synonymous with data on the percentage of accidents involving commercial vehicles in Texas."

Based on the written results and interviews, the AAJ subject did not write down the data he used in his argument. But what he uses as data in his argument is the percentage of accidents in 5 years that exist in the problems given. After that, AAJ observed that the DPS director made two statements. From these statements, AAJ compares the keywords between the statements given and the existing data. Statement 1 is considered wrong because there is no match between the words death and accident. Then statement 2 is considered accurate because of the causality of the statement with the data.

Based on Toulmin's model, the following is a summary of AAJ's subject arguments.

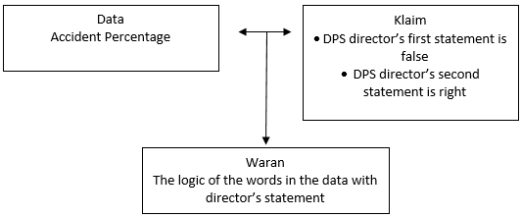

Figure 10 Summary of AAJ Subject Arguments

Even though in concluding the problems given, the subject gave two claims, the argument pattern of students with AQ levels towards climbers is Claims-Data-Warrants. Students have been careful in reviewing the claims presented by the DPS director, but they need to be more careful in utilizing the information provided in the questions.

This is in line with (R. P. Putra et al., 2022; Stoltz, 2000)where students who are included in the category of climbers are people who may have survived enough to penetrate challenges and take advantage of most of their potential that develops every day. So it can solve the problem well, but there are some solutions that need to be corrected because students need to be more careful in solving problems.

Analysis of the Argumentative Ability of Prospective Teacher Students with the AQ Climbers (S-Cl) Category

Following are the results of the LAS subject argument analysis. LAS subject claim (in this case the answer to the given problem) i.e., agree with the statement given by the DPS director. The claim is shown in the following figure.

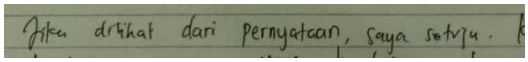

Figure 11 LAS Subject Claims

LAS claims are supported by data showing the average percentage of accidents in Texas in the last five years. The data used by the subject is shown in the following figure.

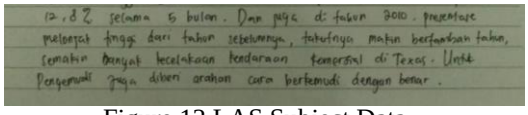

Figure 12 LAS Subject Data

LAS uses warrants in the form of its observations of increasing data patterns. The following image shows the LAS subject's written results demonstrating the warrant.

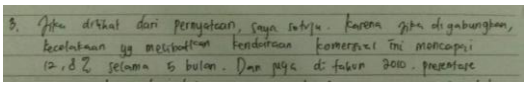

Figure 13 LAS Subject Warrants

After that, LAS added backing to support the warrants granted. The backing presented by the subject was information contained in the question regarding 1 out of 5 vehicles not permitted in 2012. This backing is indeed not visible from the written results of the LAS but can be demonstrated by LAS's explanation in the following interview.

To clarify the written results of the LAS subject, the following interview was conducted.

Researcher: "Try to briefly explain your steps in responding to the DPS Director's statement!"

S-Cl : " I agree, with the statement given by the DPS director that commercial vehicles are responsible for 15% of existing accidents. The data shown by the problem I was looking for averaged 12.8% then in the last year on the graph (2010) there was a large increase, therefore there is a high probability of an increase in the following year. In addition, there is a statement in the question that prohibits 1 in 5 vehicles from operating in 2012, which is several years after the existing graphic data. This confirms that 15% is legitimate and that the vehicle did have a role in the accident."

Based on the written results and interviews above, a summary of the LAS subject arguments can be summarized in the Toulmin model as follows:

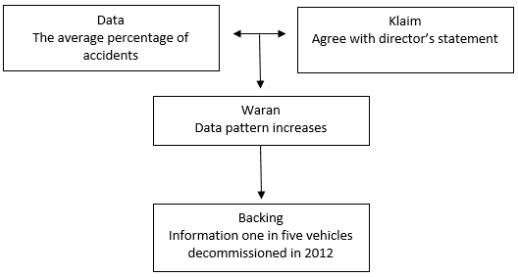

Figure 14 Summary of LAS Subject Arguments

Based on the chart above, the pattern of student argumentation at the climbers level is Claim-Data-Warrant-Backing. Compared to the two students with the AQ level below, it can be seen that there is a difference in the pattern of argumentation of students with the AQ Climber level. This is following research by (W. Hidayat et al., 2018)that students with AQ climber levels have more developed argumentation patterns. In the process, students use the concepts and knowledge they have previously acquired to solve the problems given. Then from the answers and interviews, the students looked very careful and

maximal in solving problems, as evidenced by the more complete results of students' mathematical arguments. In line with this, (Stoltz, 2000) suggests that people with the climber's personality type are very persistent, conscientious and never give up. She determination is to strive to the pinnacle of success. She will continue to try his best to achieve the set targets.

CONCLUSION

This study found that prospective teacher students had AQ levels of Camper, Towards a Climber, and Climber. For student argumentation patterns with camper AQ levels are Claims-Data-Warrants. While the argumentation pattern of students with AQ levels towards climbers is Claim-Data-Warrants, this pattern tends to be the same as campers. Then for the argumentation pattern of the climber type student is Claim-Data-Warrant-Backing. The results showed contrast in the quality of the argumentation structure based on the Adversity Quotient level when solving a problem. Differences in quality can be caused by various factors and discussions about how to improve the quality of argumentation can be the subject of further research in the future.

REFERENCES

Aaidati, I. F., Subanji, Sulandra, I. M., & Permadi, H. (2022). Student Argumentation Structure in Solving Statistical Problems Based on Adversity Quotient. *Jurnal Pendidikan Matematika*, *16*(2), 121–140.

Abdiyani, S. S., Khabibah, S., & Rahmawati, N. D. (2019). Profil Kemampuan Pemecahan Masalah Matematika Siswa SMP Negeri 1 Jogoroto Berdasarkan Langkah-langkah Polya Ditinjau dari Adversity Quotient. *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *7*(2), 123–134. https://doi.org/10.24256/jpmipa.v7i2.774

Chick, H. L., & Pierce, R. (2012). TEACHING FOR STATISTICAL LITERACY: UTILISING AFFORDANCES IN REAL-WORLD DATA. *International Journal of Science and Mathematics Education*, *10*(2), 339–362. https://doi.org/10.1007/s10763-011-9303-2

Conner, A., Singletary, L. M., Smith, R. C., Wagner, P. A., & Francisco, R. T. (2014). Teacher support for collective argumentation: A framework for examining how teachers support students' engagement in mathematical activities. *Educational Studies in Mathematics*, *86*(3), 401–429. https://doi.org/10.1007/s10649-014-9532-8

Gal, I. (2005). Statistical literacy: Meanings, components, responsibilities, the challenge of developing statistical literacy. *Reasoning and Thinking*, *1*, 47–78.

Hastuti, T. D., S, D. R. S., & Riyadi. (2018). Student profile with high adversity quotient in math learning. *Journal of Physics: Conference Series*, *983*, 12131. https://doi.org/10.1088/1742-6596/983/1/012131

Hidayat, D. F. (2020). *Hubungan kemampuan adversity quotient dan kemandirian belajar terhadap menulis matematis siswa dalam pembelajaran matematika.*

Universitas Muhammadiyah Malang.

Hidayat, W., Wahyudin, & Prabawanto, S. (2018). The mathematical argumentation ability and adversity quotient (AQ) of pre-service mathematics teacher. *Journal on Mathematics Education*, *9*(2), 239–248. https://doi.org/10.22342/jme.9.2.5385.239-248

Indrawati, K. A. D., & Febrilia, B. R. A. (2019). Pola Argumentasi Siswa Dalam Menyelesaikan Soal Sistem Persamaan Linear Tiga Variabel (Spltv). *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika*, *5*(2), 141. https://doi.org/10.24853/fbc.5.2.141-154

Kartikaningtyas, V., Kusmayadi, T. ., & Riyadi, R. (2018). The Effect of Brain-Based Learning with Contextual Approach Viewed from Adversity Quotient. *Journal of Physics: Conference Series*, *1022*(1). https://doi.org/https://doi.org/10.1088/1742-6596/1022/1/012014

Khumairoh, B., Amin, S. M., & Wijayanti, P. (2020). Penalaran Proporsional Siswa Kelas Menengah dalam Menyelesaikan Masalah Matematika Ditinjau dari Adversity Quotient. *Pedagogia : Jurnal Pendidikan*, *9*(1), 67–80. https://doi.org/10.21070/pedagogia.v9i1.259

Kim, S., Raza, M., & Seidman, E. (2019). Improving 21st-century teaching skills: The key to effective 21st-century learners. *Research in Comparative and International Education*, *14*, 174549991982921. https://doi.org/10.1177/1745499919829214

Miles, M. B., Huberman, A. M., & Saldaña, J. (2018). *Qualitative data analysis: A methods sourcebook.* Sage publications.

Moleong, L. J. (2009). *Metode Penelitian Kualitatif*. Remaja Rosdakarya.

NCTM. (2000). Principles and Standars for School Mathematics. *VA:NCTM*.

Pramesti, P., & Rosyidi, A. H. (2020). Profil Argumentasi Siswa dalam Memecahkan Masalah PISA-like Berdasarkan Model Toulmin. *Jurnal Riset Pendidikan Dan Inovasi Pembelajaran Matematika (JRPIPM)*, *3*(2), 92. https://doi.org/10.26740/jrpipm.v3n2.p92-101

Putra, R. P., Madawistama, S. T., & Heryani, Y. (2022). Kemampuan argumentasi matematis ditinjau dari adversity quotient. *Jurnal Kongruen*, *1*(2), 175–181. https://publikasi.unsil.ac.id/index.php/kongruen/article/view/206%0A https://publikasi.unsil.ac.id/index.php/kongruen/article/download/206/128

Putra, Z. R. A., & Oktaviane, D. A. K. (2022). ANALISIS HASIL BELAJAR SISWA PADA MATERI EKSPONENSIAL BERDASARKAN TINGKAT ADVERSITY QUOTIENT SISWA. *MAJAMATH: Jurnal Matematika Dan Pendidikan Matematika*, *5*(1), 61–71. https://doi.org/https://doi.org/10.36815/majamath.v5i1

Redhana, I. W. (2019). Mengembangkan Keterampilan Abad Ke-21 Dalam Pembelajaran Kimia. *Jurnal Inovasi Pendidikan Kimia*, *13*(1).

Riki Andriatna, & Kurniawati, I. (2021). Analisis Level Literasi Statistik Mahasiswa Calon Guru Matematika. *Transformasi : Jurnal Pendidikan Matematika Dan Matematika*, *5*(2), 619–632.

https://doi.org/10.36526/tr.v5i2.1497

Septianingtyas, N., & Jusra, H. (2020). Kemampuan Pemecahan Masalah Matematis Peserta Didik Berdasarkan Adversity Quotient. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *4*(2 SE-Articles). https://doi.org/10.31004/cendekia.v4i2.263

Setiawan, E. P., & Sukoco, H. (2021). Exploring first year university students' statistical literacy: A case on describing and visualizing data. *Journal on Mathematics Education*, *12*(3), 427–448. https://doi.org/10.22342/JME.12.3.13202.427-448

Soekisno, R. B. A. (2015). Pembelajaran Berbasis Masalah Untuk Meningkatkan Kemampuan Argumentasi Matematis Mahasiswa. *Infinity Journal*, *4*(2), 120. https://doi.org/10.22460/infinity.v4i2.77

Soulé, H., & Warrick, T. (2015). Defining 21st century readiness for all students: What we know and how to get there. *Psychology of Aesthetics, Creativity, and the Arts*, *9*, 178–186. https://doi.org/10.1037/aca0000017

Stoltz, P. G. (2000). *Adversity Quotient Mengubah Hambatan Menjadi Peluang*. PT Gramedia Widiasarana Indonesia.

Sukmaningrum, R., & Kurniasari, I. (2022). Profile of student's algebraic thinking in solving mathematics problems reviewing from adversity quotient. *Jurnal Pijar Mipa*, *17*(2), 252–259. https://doi.org/10.29303/jpm.v17i2.3349