

Statistical Thinking Ability in Solving Statistical Problems Through Adversity Quotient

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Abstrak

Statistical thinking ability menjadi kompetensi krusial bagi mahasiswa teknik industri, khususnya dalam memecahkan masalah statistik di dunia industri yang menuntut analisis data yang akurat dan pengambilan keputusan berbasis data. Penelitian ini bertujuan untuk mengidentifikasi dan menganalisis hubungan antara Adversity Quotient (AQ) dengan statistical thinking ability mahasiswa teknik industri. Penelitian menggunakan desain deskriptif kuantitatif dengan pendekatan ex post facto, melibatkan 115 mahasiswa tingkat akhir yang dikelompokkan berdasarkan tingkat AQ menjadi tiga kategori: climber, camper dan quitter. Data dikumpulkan melalui angket Adversity Response Profile (ARP), esai, dan wawancara, serta post-test statistical thinking. Analisis dilakukan melalui perhitungan rata-rata, persentase, distribusi frekuensi, dan analisis inferensial untuk menguji perbedaan antar kelompok. Hasil penelitian menunjukkan bahwa mahasiswa dengan AQ tinggi memiliki kemampuan statistical thinking yang lebih baik dibandingkan kelompok AQ sedang dan rendah. Temuan ini menegaskan pentingnya penguatan AQ dalam proses pembelajaran statistik, sehingga dapat meningkatkan ketahanan mental, motivasi, dan pemecahan masalah statistik di kalangan mahasiswa teknik industri. Penelitian ini merekomendasikan integrasi strategi penguatan AQ dalam pembelajaran statistik untuk menghasilkan lulusan yang lebih adaptif dan kompetitif.

Kata Kunci: Statistical Thinking Ability; Adversity Quotient; teknik industri

Abstract

Statistical thinking ability is a crucial competency for industrial engineering students, especially in solving statistical problems in the industrial world, which requires accurate data analysis and data-driven decision making. This study aims to identify and analyze the relationship between Adversity Quotient (AQ) and statistical thinking ability in industrial engineering students. The study employs a quantitative descriptive design with an ex post facto approach, involving 115 final-year students grouped into three categories based on their AQ levels: climbers, campers, and quitters. Data were collected through the Adversity Response Profile (ARP) questionnaire, essays, interviews, and a post-test on statistical thinking. Analysis was conducted using mean calculations, percentages, frequency distributions, and inferential analysis to test differences between groups. The results of the study indicate that students with high AQ have better statistical thinking abilities compared to those with moderate and low AQ. These findings emphasize the importance of strengthening AQ in the statistical learning process, thereby enhancing mental resilience, motivation, and statistical problem-solving skills among industrial engineering students. This study recommends integrating AQ-strengthening strategies into statistical education to produce more adaptive and competitive graduates.

Keywords: Statistical Thinking Ability; Adversity Quotient; industrial statistics

I. INTRODUCTION

The rapid development of the industrial world in today's digital era requires college graduates, especially industrial engineering students, to have a variety of outstanding competencies. One of the most vital competencies is statistical thinking ability. This ability is not limited to understanding statistical concepts, but rather emphasizes the ability to reason, analyze data, identify patterns, and make logical and systematic data-based decisions (Garfield & Ben-Zvi, 2022). In the real world of work, industrial engineering students are required to be able to solve complex problems through accurate data analysis and proper interpretation in order to support managerial and operational decision-making processes.

Statistical thinking ability is fundamental because almost all aspects of modern industry rely heavily on data. Data is not only used as material for evaluation or reporting, but also as a basis for strategic decision-making, trend prediction, risk analysis, and the design of more efficient and effective production systems (Garfield & Ben-Zvi, 2022). In higher education, particularly in industrial engineering programs, students are required not only to understand statistical theories and formulas, but also to be able to apply them in real-world contexts, whether through case studies, final projects, or industrial internships.

In fact, many industrial engineering students still experience difficulties in solving statistical problems, especially those that require high-level thinking. These difficulties are not only caused by a weak grasp of the material, but are also closely

related to non-cognitive aspects such as motivation, resilience, and the ability to cope with pressure or challenges during the learning process (Setyorini et al., 2023). Based on observations, many industrial engineering students still experience difficulties in solving statistical problems, especially those that are complex and require critical thinking and in-depth analysis. Students consider statistics to be a difficult, abstract, and even intimidating subject. In reality, in the world of work, the ability to think statistically in a critical and creative manner is very important, as it is very helpful in solving real-world problems in the field, such as production quality control, process optimization, and supply chain system analysis (Setyorini et al., 2023). In this context, Adversity Quotient (AQ) or intelligence in facing difficulties is one of the important factors that has not been studied in depth in relation to the statistical thinking ability of industrial engineering students.

A person's ability to cope with difficulties is referred to as Adversity Quotient (Wulandari et al., 2023). According to Stolz (2018), Adversity Quotient is a variable that determines a person's resilience in persevering through challenges and overcoming difficulties in achieving success. Adversity Quotient was first introduced by Stoltz (1997) as a concept that describes the extent to which a person is able to persevere, adapt, and bounce back from difficulties. Individuals with high AQ tend to be better at managing stress, do not give up easily when faced with difficult problems, and have the initiative to find solutions to various problems (Putra et al., 2023; MZ et al., 2024). In the context of learning, especially in statistics courses, AQ plays an

important role in determining how effectively students are able to face various academic challenges.

AQ is important in understanding the concept of statistical thinking ability. Statistical thinking ability is an individual's ability to understand, analyze, interpret, and make decisions based on available data and statistical information (Garfield & Ben-Zvi, 2008). This ability not only includes an understanding of basic statistical concepts, but also involves critical, logical, and reflective thinking processes in solving data-based problems. Students with good statistical thinking ability will be able to identify problems, determine the appropriate analysis strategy, and draw conclusions objectively based on the data results (Romadoni, Sahrudin, & Rosdianwinata, 2023; Syaripah, 2024).

The process of learning statistics is often characterized by problems with a high level of complexity that require mental endurance and perseverance. In this situation, Adversity Quotient becomes one of the main determining factors that influence the extent to which students can optimize their statistical thinking ability. Students with high AQ are better prepared to face challenges, able to develop problem-solving strategies, and are less likely to become frustrated when encountering highly difficult problems (Utomo & Surya, 2021). Conversely, students with low AQ tend to give up easily and have difficulty managing academic pressure.

Stolz (2018) categorizes AQ into three types, namely Climber, Camper, and Quitter. Climbers are individuals who have strong beliefs and understanding to

immediately solve problems, consider risks, and pursue rewards (Mulyani, Wahyuningsih, & Natalliasari, 2019). Quitters are individuals who tend to give up before trying, lack ambition, and avoid risks (Puspita, Herman, & Dahlan, 2023). Meanwhile, Campers are individuals who are able to face problems but stop halfway because they feel incapable (Ni Wayan et al., 2020; Sari, Sukestiyarno, & Walid, 2022). In addition, Stoltz (1997) divides AQ into four dimensions, namely Control (the ability to control situations), Ownership (a sense of responsibility for problems), Reach (the scope of the influence of difficulties on other aspects), and Endurance (resilience in facing difficulties). Statistical thinking skills and Adversity Quotient are two complementary aspects that support student success, particularly in facing statistical learning challenges in higher education. The integration of these two concepts will provide a more comprehensive picture of the factors that influence student academic performance, while also helping to design more effective educational interventions.

For industrial engineering students, AQ is very important because the learning process, especially in statistics courses, often presents various challenges. Students with high AQ are generally more resilient when faced with complex problems, more proactive in seeking solutions, and less likely to give up when faced with failure. They are also more capable of managing stress, finding meaning in every failure, and motivating themselves to continue learning and developing (Utomo & Surya, 2021).

These four dimensions play an important role in determining how individuals respond to and take responsibility for the difficulties they face, which can ultimately encourage improvement in the learning process. In the context of statistical thinking, these dimensions are closely related to student abilities. Based on this description, the author is interested in researching this topic further, focusing on the analysis of statistical thinking in terms of students' Adversity Quotient.

II. METHOD

This study uses a quantitative descriptive approach with descriptive analysis techniques. This approach was chosen because it was considered most appropriate for describing and analyzing phenomena that occur naturally in the student learning environment, without any treatment or intervention that might cause research bias. Through this method, researchers can observe and describe the relationship between Adversity Quotient (AQ) and students' statistical thinking ability objectively, based on existing data.

The method used in this study is an ex post facto design, which is a research design in which the researcher does not provide treatment, manipulation, or intervention to the independent variables. The researcher only conducted an assessment of the conditions that had occurred in the sample group. Thus, all dynamics and interactions that occurred between the research variables were analyzed based on existing realities, not the results of experiments or deliberate manipulation. This design choice was highly relevant, given that the main objective of the study was to understand

and analyze the extent of the relationship between students' Adversity Quotient levels and their statistical thinking ability.

This study attempts to identify the potential causal relationship between Adversity Quotient as an independent variable (X) and statistical thinking ability as a dependent variable (Y). In this context, the researcher seeks to explore how students' AQ levels can influence their statistical thinking ability skills. The main focus is on understanding and describing the natural relationship that has formed between the two variables in a real environment, not in an engineered situation.

This approach allows researchers to gain a deep understanding of the patterns that emerge in the learning process, particularly in relation to the influence of AQ on students' statistical thinking ability. Thus, this research design focuses on analyzing the relationship between the independent variable, namely Adversity Quotient, and the dependent variable, namely statistical thinking ability. Through a quantitative descriptive and ex post facto approach, this study is expected to make a real contribution to the development of more effective learning strategies, particularly in supporting the development of statistical thinking ability among industrial engineering students. Thus, this study aims to understand the extent to which Adversity Quotient influences students' statistical thinking ability, without direct intervention from researchers on the variables studied. The variables are statistical thinking ability as the dependent variable (Y) and Adversity Quotient (AQ) as the independent variable (X). The research design is as follows in Figure 1.

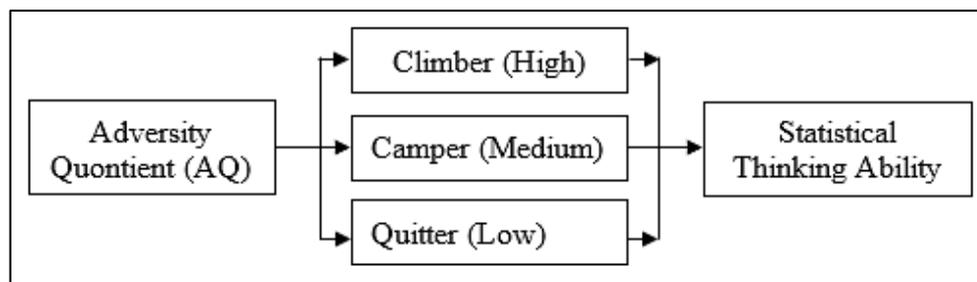


Figure 1. Research Design

This study was conducted on fourth-year students in the Industrial Engineering Study Program. A total of 115 fourth-year students were involved as the research population, with sampling techniques using systematic random sampling. The sampling procedure began with random selection of the first element, then continued systematically based on a predetermined interval. The sampling results showed that there were 40 students with the Climber type, 42 students with the Camper type, and 33 students with the Quitter type.

The data analysis techniques used in this study include descriptive analysis and inferential analysis. Descriptive analysis is used to describe the Adversity Quotient profile and statistical thinking abilities, based on data collected through questionnaires and tests. The data was processed to obtain mean values, percentages, and frequency distributions, thereby providing a comprehensive overview of the conditions of each variable studied. Inferential analysis was used to test differences in statistical thinking abilities based on Adversity Quotient categories (high, medium, and low). This analysis aims to determine whether there are significant differences or meaningful effects between Adversity Quotient categories on statistical thinking abilities. Thus, the application of these two analysis techniques is very

appropriate for the descriptive quantitative research objectives and is supported by the ex post facto research design. This approach is expected to provide a deeper understanding of the relationship between Adversity Quotient and statistical thinking abilities among industrial engineering students.

The data collection technique in this study was conducted through a post-test specifically designed to measure students' statistical thinking abilities. The instrument used consisted of two main questions which were then developed into four branch questions, so that students' statistical thinking abilities could be analyzed in greater depth and comprehensively. After the students completed the test, all answer sheets were collected and scored based on assessment guidelines that had been compiled in accordance with statistical thinking indicators.

The data collected in this study was then processed to produce average values, percentages, and frequency distributions. This process was carried out in order to provide a comprehensive overview of the conditions of each variable studied. Descriptive analysis was also used to identify differences in each statistical thinking ability indicator based on Adversity Quotient categories, whether high, medium, or low. With this approach,

researchers can assess whether there is a significant relationship or influence between the Adversity Quotient level and each aspect of students' statistical thinking abilities.

The application of these two analytical techniques is very much in line with the research objectives, which prioritize a qualitative descriptive approach and apply an ex post facto design, where observations are made without direct intervention in the variables. Data collection was carried out through a post-test specifically designed to measure students' statistical thinking ability. After the test was completed, the participants' answer sheets were collected and scored according to the previously established statistical thinking ability indicator assessment guidelines. This process ensured an objective and in-depth assessment of students' statistical thinking ability in accordance with their respective Adversity Quotient categories.

III. RESULT AND DISCUSSION

Based on the data shown in Table 1, it is known that the Adversity Quotient level of students in the Industrial Statistics II course is mostly in the moderate category. This shows that the majority of students have fairly good abilities in facing challenges and difficulties during the mathematics learning process. Thus, students are generally able to adapt and persevere even when facing obstacles in understanding industrial statistics material.

Table 1.
Adversity Quotient

ARP Interval	Type AQ	Frecuency	Percentage
166 – 200	Climber	36	31%

95 – 165	Camper	47	41%
0 – 94	Quitter	32	28%

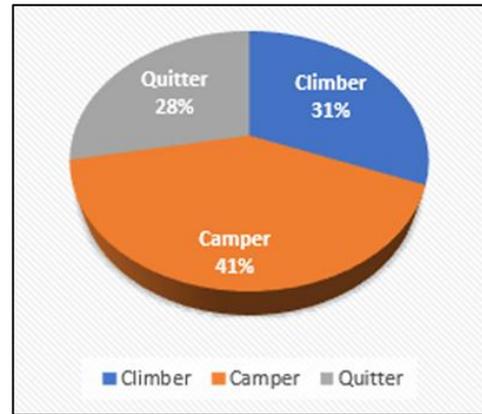


Figure 1. Adversity Quotient Percentage

Based on the percentages, 28% are quitters, 31% are climbers, and 41% are campers. This shows that out of 115 students, 32 students have low adversity, 47 students have moderate adversity, and 36 students have high adversity. Furthermore, we will look at the students' statistical thinking abilities descriptively in Table 2.

Table 2.

Statistical Thinking Ability								
N	M	Me	Mo	M	M	Ra	SD	Var
	ean	dia	dus	ax	in	ng		
	n	n				e		
1	65,	64	66	9	5	39	10	112
1	7			0	0		,2	.23
5							3	

Table 2 shows that the average score is 65.7, with the highest score being 90 and the lowest score being 50. Statistical thinking ability based on indicators is explained in Table 3.

Table 3.

Average Statistical Thinking Ability Indicator	
Statistical Thinking Indicator	Mean
Distinguish between different forms of data presentation	80,51
Explain data grouping and sorting in detail	55,50
Represent Data	74,31

Statistical Thinking Indicator	Mean
Analyze and Interpret Data	50,21

Based on Table 3, the indicator that distinguished data presentation obtained the highest average of 80.51, while the indicator with the lowest average was analyzing and interpreting data with an average value of 50.21. In Table 4, AQ climbers had the highest statistical thinking score of 79.02, with the highest score of 87.00 and the lowest score of 70.00, with a score difference of 7.98 among climber group students.

Table 4.

Statistical Thinking Ability								
AQ	N	M	Me	Mo	M	Mi	SD	Var
		ean	dian	dus	ax	n		
Climber	3	79	79.	79.	87	70	4.	24.
	6	.0	02	00	.0	.0	87	65
Camper	4	64	64.	65.	72	55	3.	14.
	7	.7	00	00	.0	.0	75	01
Quitter	3	54	54.	50.	58	50	3.	9.9
	2	.5	00	00	.0	.0	12	69
		5			5	0	7	

Based on Table 4, the researcher provides the following information on the average Adversity Quotient scores.

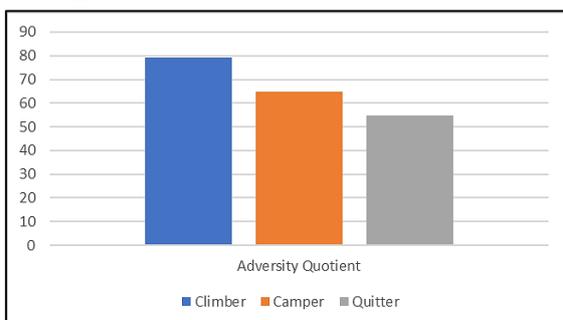


Figure 3. Statistical Thinking Ability Result Analysis

Figure 3 explains the results of the analysis of students' statistical thinking ability based on adversity quotient, namely climber, camper, quitter. Table 5 explains that the AQ-based statistical thinking indicator has the highest average value in the indicator of distinguishing the form of data presentation completely at 95.00.

Table 5.

Statistical Thinking Ability based on Adversity Quotient per Indicator

Statistical Thinking Ability Indicator	Average Coefficient of Resistance to Difficulties in Statistical Thinking Ability		
	Climber	Camper	Quitter
Distinguish between different forms of data presentation	95.00	85.76	70.32
Explain data grouping and sorting in detail	55.02	47.42	37.51
Represent Data	62.55	36.43	22.23
Analyze and Interpret Data	85.47	72.84	65.53

The ability to analyze and interpret data is one of the key indicators of statistical thinking ability, which greatly determines the quality of a person's understanding of data and fact-based decision making. However, students have not achieved optimal results. One of the main reasons for this is their limited understanding of statistical concepts, especially those related to the data analysis process, which is not only mechanical but also requires critical and reflective thinking skills (Garfield & Ben-

Zvi, 2008). Academically, this low ability is often associated with a learning approach that is still oriented towards memorizing formulas or technical procedures, rather than understanding the meaning and interpretation of data. Students are often skilled at performing statistical calculations procedurally, but have difficulty when asked to interpret the meaning of the results obtained or relate them to the context of real-world problems (Wild & Pfannkuch, 1999). As a result, they experience obstacles in identifying patterns, drawing valid conclusions, or communicating findings logically and critically.

In addition, other factors contributing to low data analysis and interpretation skills are a lack of real-world case-based training and limited experience in working with complex data. Chance (2002) also found in his research that statistics learning that focuses on conventional problems without involving authentic data from industry or everyday life tends to make it difficult for students to transfer statistical knowledge to a broader context. The low indicator of "analyzing and interpreting data" reflects the conceptual, methodological, and psychological challenges faced by students, as well as the need for more contextual, integrative, and real-world problem-solving-based statistical learning innovations.

From a psychological perspective, low self-confidence, math anxiety, and a lack of Adversity Quotient (AQ) can also affect students' ability to analyze and interpret data. Students who easily give up or are reluctant to try to tackle complex data problems tend not to develop the critical thinking skills needed in statistical thinking (Stoltz, 1997; Utomo & Surya, 2021).

The results show that the majority of students fall into the moderate Adversity Quotient category, with the largest proportion being Camper types. This indicates that most students are quite capable of facing challenges in solving statistical problems, although they are not yet optimal in actively managing difficulties like Climber types. This finding is in line with the research by Ni Wayan et al. (2020), which classifies Camper students as individuals who have the potential to face problems but tend to give up when they feel incapable.

Based on statistical thinking, the average score of students was moderate, with a dominance in the first indicator, namely Distinguishing the form of data presentation completely. This indicates that students find it easier to distinguish the form of statistical data presentation.

Analysis based on AQ type shows that Climber-type students have a higher average statistical thinking score than Camper and Quitter types. The higher the AQ level, the higher the statistical thinking score achieved by students. This reinforces Stolz's (2018) view that AQ is closely related to mental endurance and the ability to complete challenges, including in cognitive contexts such as statistical problem solving.

The implications of this study's findings indicate that strengthening students' Adversity Quotient (AQ), particularly in the aspects of control, origin-ownership, reach, and endurance, needs to be addressed in the Industrial Statistics II course. This study has limitations, as it only involved one cohort at the fourth level; this sample may not represent the population of all students at every level. The researchers were limited

to a literature review and did not directly test AQ-based learning interventions.

IV. CONCLUSION

Based on the results of data analysis, this study shows that there is a significant difference in students' statistical thinking ability based on their Adversity Quotient (AQ) level. Students with high AQ consistently demonstrate better statistical thinking ability than students with moderate or low AQ, with average differences of 14.24 and 24.47, respectively. Meanwhile, the difference between students with moderate and low AQ is also quite significant, at 10.23.

These findings emphasize the importance of AQ in supporting the development of students' statistical thinking skills. Therefore, the results of this study can be used as a reference for lecturers, especially in statistics courses, to pay more attention to efforts to improve AQ in the learning process. Lecturers are expected to integrate learning strategies that not only emphasize cognitive aspects but also develop students' resilience and fighting spirit in facing academic challenges.

Thus, the results of this study provide a valuable contribution to efforts to improve the quality of statistics learning, thereby creating a more meaningful, adaptive, and relevant learning experience for students in the challenging era of Industry 4.0.

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