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The Correlation Between Adversity Quotient and Critical Thinking Ability of Chemistry Education Students

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Abstract

In the globalization era, the ability to think critically is a crucial skill for students to navigate through tough competition. One internal factor influencing a person's critical thinking ability is Adversity Quotient (AQ). It provides an overview of how well students can respond and tackle obstacles while honing their essential thinking skills. This study explored the correlation between AQ and students' critical thinking abilities, specifically when working on chemistry problems related to salt hydrolysis. The research involved 30 students majoring in Chemistry Education, selected using a proportional stratified random sampling technique. A questionnaire was administered to measure AQ, while students' critical thinking skills were assessed through a description test. Subsequently, the data were analyzed using the Pearson correlation test, which yielded a correlation coefficient of 0.299, indicating that the correlation between AQ and students' critical thinking skills was not significant ($p>0.05$). Further analysis is required to delve deeper into the correlation between AQ and critical thinking and identify other factors influencing necessary thinking skills.

Keywords: adversity quotient; critical thinking; hydrolysis

Abstrak

Di era globalisasi, kemampuan berpikir kritis merupakan keterampilan penting bagi siswa. Salah satu faktor internal yang mempengaruhi kemampuan berpikir kritis seseorang adalah Adversity Quotient (AQ). AQ memberikan gambaran tentang seberapa baik siswa dapat merespons dan mengatasi hambatan sambil mengasah keterampilan berpikir penting mereka. Penelitian ini bertujuan untuk mengetahui korelasi antara AQ dan kemampuan berpikir kritis siswa, khususnya ketika mengerjakan soal kimia yang berkaitan dengan hidrolisis garam. Penelitian ini melibatkan 30 mahasiswa jurusan Pendidikan Kimia yang dipilih menggunakan teknik proporsional stratified random sampling. Kuesioner diberikan untuk mengukur AQ, sedangkan kemampuan berpikir kritis siswa dinilai melalui tes uraian. Selanjutnya data dianalisis menggunakan uji korelasi Pearson yang menghasilkan koefisien korelasi sebesar 0,299 yang menunjukkan bahwa hubungan antara AQ dengan kemampuan berpikir kritis siswa tidak signifikan ($p>0,05$). Analisis lebih lanjut diperlukan untuk menggali lebih dalam korelasi antara AQ dan berpikir kritis dan mengidentifikasi faktor-faktor lain yang mempengaruhi keterampilan berpikir yang diperlukan.

Kata kunci: hasil kesulitan; berpikir kritis; hidrolisis

Introduction

The rapid development of science, technology, and information in the globalization era has intensified competition between nations worldwide. To face this competition, it is crucial to enhance the quality of human resources in Indonesia through improvements in education. Unfortunately, this country's current state of education lags behind that of other nations. Therefore, education is crucial to the country's progress (Suardana, Redhana, Sudiatmika, & Selamat, 2018).

One significant skill that undergraduate students should possess in this era of globalization is critical thinking. However, various studies indicate that Indonesian students' critical thinking level remains relatively low. They are less skilled in critical thinking (Farcis, 2019; Rasmawan, 2017), especially in subjects like mathematics (Munawwarah, Laili, & Tohir, 2020). Therefore, efforts to enhance critical thinking skills are essential to raising the overall quality of education in Indonesia. In this regard, the Chemistry Education study program at UIN Walisongo Semarang is actively involved in improving students' critical thinking abilities. They achieve it by aligning the curriculum with the regulations stated in the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 3 of 2020 on National Education Standards.

The learning curriculum employed during industrial revolution 4.0 is competency-oriented, emphasizing literacy strengthening, Higher Order Thinking Skills (HOTS), the 4 Cs (Critical Thinking, Collaboration, Creativity, and Communication), network-based learning, and lifelong learning. Semester Learning Plans (RPS) for courses are developed with a focus on student-centered learning principles. The process is characterized as interactive, holistic, integrative, scientific (research-based), contextual, thematic, practical, collaborative, prospective, pluralistic, student-centered, and competency-oriented in the context of the industrial revolution 4.0.

Various factors influence a person's critical thinking ability, including personal characteristics, problem attributes, learning approaches, external factors, and points of view (Muhibbin, 2003; Nada & Sari, 2022). Among the internal factors is a person's ability to respond to and overcome obstacles, known as the Adversity Quotient (AQ). AQ is considered crucial in education, as it enables individuals to persist in the face of difficulties and achieve high academic performance (Phoolka & Kaur, 2012). It involves using intelligence to adapt thinking and actions when confronted with obstacles and turning them into opportunities (Annastasya, Sumaryoto, & Suryana, 2019; Stoltz, 1999). Developing AQ helps students cultivate divergent thinking skills and enhances their problem-solving abilities. While people still emphasize the essence of the Intelligence Quotient (IQ) for success, AQ plays an equally significant role in determining one's achievements (Kuhon, 2020). Several studies have highlighted the impact of AQ on creative thinking and students' reasoning abilities (Hidayat, 2017; Nursa'adah & Rosa, 2016). It has been discovered that students with high AQ exhibit better divergent thinking abilities compared to those with low AQ (Fauziah, Marmoah, Murwaningsih, & Saddhono, 2020).

Other studies have demonstrated that critical thinking skills are influenced by factors such as self-regulation. Hence, teachers and lecturers need to observe and encourage good student self-regulation. When learners practice effective self-regulation, they become more independent, managing their learning patterns and increasing their motivation to improve their critical thinking skills (Bastian, Huda, & Yudistira, 2022). This self-regulation is closely related to Adversity Quotient (AQ), which measures a person's ability to overcome difficulties.

Through interviews conducted with Chemistry Education students at UIN Walisongo Semarang, it was discovered that they encountered numerous challenges while attending lectures and completing assignments, including feelings of laziness,

boredom, loss of enthusiasm, and occasional overwhelm and depression in certain subjects. Critical thinking was required for the assignments given to students. They acknowledged that they needed a resilient attitude and the ability to handle these obstacles to turn them into opportunities for personal growth. Therefore, the present study explored the correlation between students' AQ and their critical thinking skills in the context of Chemistry Education at UIN Walisongo Semarang. While previous research has shown that AQ could influence learning outcomes and mathematical abilities, there has been limited specific investigation on its impact on critical thinking skills. As a result, this study aimed to determine students' AQ levels, their critical thinking skills, and the correlation between AQ and critical thinking abilities among Chemistry Education students.

Method

This quantitative correlational study examined the correlation between AQ (Adversity Quotient) and critical thinking skills among Chemistry Education students, focusing on salt hydrolysis materials. The study selected a sample of 30 Chemistry Education students using a proportional stratified random sampling technique. To collect data, a questionnaire was administered to assess students' AQ levels, while essay questions on salt hydrolysis materials were involved to evaluate their critical thinking skills. Two experts validated the questionnaire and essay questions to ensure their accuracy and reliability. Subsequently, data analysis was conducted employing an assessment rubric, and the correlation between AQ and critical thinking skills was assessed through the product-moment correlation test. The research flow is displayed in Figure 1.

Figure 1.
Research Flow

Result and Discussion

Student AQ Level

The AQ score data were collected from 30 respondents who responded to 40 statements using scoring guidelines employing a Likert scale with scores ranging from 1 to 4. The highest score obtained was 152, while the lowest was 77. On average, respondents scored 116.63, with a standard deviation of 16.02. Table 1 below presents the categorization of AQ scores based on the mean and standard deviation calculation. Table 1 indicates that Chemistry Education students' average Adversity Quotient (AQ) falls within the moderate category. The frequency distribution of the AQ categories is depicted in Figure 2.

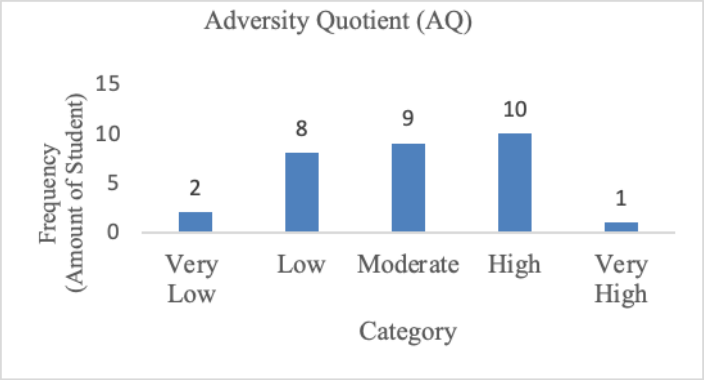
Table 1.
Adversity Quotient Categorization Guidelines

Interval	Category
X ≤ 92.61	Very low
92.61 < X 108.63	Low
108.63 < X 124.64	Moderate
124.64 < X 140.66	High
140.66 < X	Very high

(Stoltz, 1999)

Based on Figure 2, the frequency of students with different levels of AQ can be summarized as follows: 2 students (3.3%) were in the very low category, 8 students (26.67%) in the low category, 9 students (30%) in the moderate category, 10 students (33.33%) in the high category, and 1 student (3.33%) in the very high category. AQ is divided into four dimensions: control, origin and ownership, reach, and endurance. The average scores for each AQ indicator were as follows: 27.13 for the control indicator, 30.1 for the origin and ownership indicator, 27.57 for the reach indicator, and 31.87 for the endurance indicator.

Figure 2.
Adversity Quotient Categorization Charts



The control dimension in AQ pertains to how people control themselves when facing difficulties. Safi'i et al. (2021) suggest that a lower score on the control dimension indicates that people may believe there is nothing they can do to address these issues, assuming those are beyond their reach. Conversely, a higher score on the control dimension implies that a person believes there is always a way to deal with difficulties when faced with them.

The results demonstrated that 17 students' AQ scores on the control dimension were below the average (27.13), while 13 others had above-average scores. On average, students' scores on this dimension were classified within the moderate category. It signifies that Chemistry Education students were generally resilient and not easily discouraged by complex problems. However, they might struggle to maintain a sense of control when faced with challenges of a more severe nature.

The second dimension refers to origin and ownership, which involves understanding where difficulties originate and how individuals perceive consequences. A lower score on the origin and ownership dimension indicates a tendency to blame oneself and disregard constructive solutions (Stoltz, 1999). Conversely, a higher score suggests a person is more inclined to see external factors as the source of difficulties and take responsibility appropriately. In this study, 15 students scored above the average (30.1) on the origin and ownership dimension, while 15 others scored below the average. Hence, the average student score on this dimension was moderate.

The third dimension is "reach," assessing how difficulties impact other aspects of a person's life. According to Safi'i et al. (2021), a lower score on the reach dimension indicates that an individual may perceive an unfavorable incident as a disaster and allow it to spread without attempting to control it. Conversely, a higher score suggests that the person is more likely to limit the scope of the problem to the specific issue at hand. In the present study, 10 students scored below the average (27.57) on the reach dimension, while 20 achieved above the average. Thus, the average student score on this dimension was classified within the moderate category.

The fourth dimension in the context of AQ is endurance, which refers to a person's perception of how long adversity

lasts and how long the triggering factors persist. A lower score on the endurance dimension indicates that a person is more likely to perceive difficulties and their causes as long- lasting or permanent. In comparison, a higher score suggests that an individual views difficulties as temporary (Stoltz, 1999). In this study, the AQ scores of 17 students' were found to be above the average (31.87) on the endurance dimension, while 13 others scored below the average. Therefore, the average student score on the endurance dimension was included within the moderate category.

From these findings, most Chemistry Education students were found to have a good AQ. Most respondents already possessed an AQ above the average, indicating their ability to tap into their potential and achieve success. AQ influences student achievement motivation, learning independence, and performance (Stoltz, 1999). Those who apply AQ effectively tend to perform optimally when faced with difficulties and challenges. Moreover, AQ's influence extends beyond personal abilities and attitudes and ultimately affects education (Hema & Gupta, 2015; Juwita, Roemintoyo, & Usodo, 2020).

Student Critical Thinking Ability

The research data presents scores of critical thinking skills related to salt hydrolysis material collected from 30 respondents. The assessment consisted of 11 questions using scoring guidelines with scores ranging from 1 to 4. The highest obtained score was 79.55, while the lowest was 9.09. On average, respondents obtained 51.14. These results indicated that Chemistry Education students' average critical thinking ability was classified into the low category. In addition, critical thinking ability is classified into five categories. The frequency distribution of students' critical thinking ability categories can be found in Table 2.

Table 2.
Frequency Distribution of Critical Thinking Ability Category

Score	Category	Frequency	Percentage (%)
81.25 < X 100	Very high	0	0
71.50 < X 81.25	High	2	6.67
62.50 < X 71.50	Moderate	7	23.33
43.75 < X 62.50	Low	12	40
0 < X 43.75	Very low	9	30
Total		30	100

Based on the data presented in Table 2, the frequency distribution of students' critical thinking skills across different categories is as follows: 9 students (30%) were in the very low category, 12 students (40%) were in the low category, 7 students (23.33%) were in the moderate category, 2 students (6.67%) were in the high category, and there was no student (0%) in the very high category. The indicators employed to determine critical thinking skills included giving simple explanations, building basic skills, making conclusions, giving further explanations, and setting strategies or tactics. The average scores for each indicator are as follows: 44.17 for giving simple explanations, 49.91 for building basic skills, 50.67 for making conclusions, and 54.38 for giving further explanations.

Regarding giving simple explanations, most students' critical thinking skills were still in the very low category, with 16 students falling into this group. The average score for this aspect was 44.17, placing it within the low category. Students had shown proficiency in focusing on problems, analyzing them, and answering questions based on descriptions (Supriyati, Setyawati, Purwanti, Salsabila, & Prayitno, 2018). Developing critical thinking skills in this aspect can be achieved through regular exercises that involve formulating and responding to problems requiring explanations (Hidayat, Rahayu, & Rahmawati, 2016).

Regarding the aspect of building basic skills, most students' critical thinking skills were also in the low category, with 12 students falling into this classification. The average score for this aspect was 49.91, placing it in the low category. Building basic skills is crucial to guide students in observing and evaluating things firsthand (Hidayat et al., 2016). The indicators encompass considering the credibility of sources and making observations and evaluations of the results (Crismasanti & Yunianta, 2017).

Regarding making conclusions, the critical thinking skills of most students were categorized as low, with 12 students falling into this group. The average score for this aspect was 50.67, also classified as low. Most students had not yet demonstrated the ability to write comprehensive conclusions supported by appropriate reasoning. Similarly, regarding the aspect of giving further explanations, most students' critical thinking skills were in the low category, with 12 students falling into this classification. The average score for this aspect was 54.38, indicating a low level of proficiency. Key indicators for giving further explanations involved identifying terms, definitions, and assumptions (Supriyati et al., 2018). Regarding setting strategies or tactics, the average students' critical thinking ability was also classified into the low category, with an average score of 59.38. Indicators in this aspect included identifying actions and interacting with others (Supriyati et al., 2018). A potential approach to developing critical thinking skills among Chemistry Education students is encouraging them to think through and solve case studies to improve their critical thinking abilities (Tammy Lapoint-O'Brien, 2013).

Based on the presented results, the clear conclusion was that Chemistry Education students' critical thinking ability tends to be low in all aspects. Several factors might contribute to this situation, including psychological factors such as intellectual development, level of anxiety, and motivation (Dores, Wibowo, & Susanti, 2020). Motivated students are more likely to persist in tasks that require critical thinking (Lai, 2011). Besides, physiological factors like physical conditions, interaction factors, and learning independence also play a role. Notably, a significant correlation exists between learning styles, critical thinking, and academic performance (Ghazivakili et al., 2014). Thus, there is a strong need to develop critical thinking skills to enhance decision-making abilities in education (Mahapoonyanont, 2010). It has been observed that students with strong critical thinking skills and open-mindedness tend to perform better academically (Changwong, Sukkamart, & Sisan, 2018).

Correlation between AQ and Critical Thinking Ability

Based on the correlation test results, the correlation coefficient between AQ and students' critical thinking skills was 0.196. It indicated an insignificant correlation between AQ and critical thinking skills among Chemistry Education students focusing on salt hydrolysis material. In this regard, a correlation coefficient within the range of 0.00-0.199 is included in the insignificant correlation category.

The significance value of the correlation obtained was 0.299, greater than 0.05. Therefore, the null hypothesis (h0) was accepted, while the alternative hypothesis (ha) was rejected. In other words, there was no significant correlation between AQ and critical thinking skills among Chemistry Education students focusing on salt hydrolysis material. Similarly, there was no significant correlation between AQ and students' critical thinking skills in mathematics (Widaningsih et al., 2020).

The contribution of AQ in influencing critical thinking skills was 32.61%, while the remaining 67.40% of critical thinking abilities were affected by other factors (Heryadi, 2021), including physical condition, intellectual development, motivation, anxiety, consistency, feelings, and habits (Wayudi, Suwatno, & Santoso, 2020). Among these factors, the most influential one on critical thinking skills is the habit (Nada & Sari, 2022). Thus, it is essential to note that the lack of practice can lead to low levels of critical thinking skills in

individuals (Farcis, 2019). Moreover, critical thinking is a skill that can be taught and requires consistent practice (Yuliati, 2013). Therefore, its success depends on how consistently students practice the relevant skills (Heryadi, 2021). To foster critical thinking abilities, efforts must be made to encourage and support students in their practice. Additionally, the management should play a proactive role in promoting the development of critical thinking abilities, allowing students to build resilience to tackle various problems and conflicts during the learning process (Baharun & Adhimah, 2019).

Chemistry Education students at UIN Walisongo Semarang were not accustomed to thinking critically, resulting in low scores on the critical thinking ability test, particularly on salt hydrolysis material. Despite having high motivation and AQ scores, their critical thinking ability remained in the low category. Hence, it is essential to sharpen critical thinking skills, as they significantly impact test scores. Although this study demonstrated that AQ did not directly affect critical thinking skills, students should still strive to improve their AQ by persistently solving problems and maintaining optimism in encountering challenges, as better AQ positively correlates with improved learning outcomes. Moreover, AQ and critical thinking skills are crucial in enhancing student achievement (Leonard & Amanah, 2014). In this regard, people with high AQ perform optimally when encountering difficulties (Hema & Gupta, 2015). Considering that each individual has a unique personality and different ways of dealing with problems, several other factors influencing critical thinking skills must also be considered (Nursa'adah & Rosa, 2016).

Critical thinking ability is a learned and developed skill that requires conscious effort and habituation (Heryadi, 2021). As a solution from this research, Chemistry Education students are encouraged to practice critical thinking more often by engaging in practice questions and activities that stimulate critical thinking. Furthermore, students with critical thinking skills ask meaningful and challenging questions and actively participate in learning (Murawski, 2014). Contextual learning materials affect their cognitive abilities, and teachers or lecturers, as facilitators, can aid in developing their critical thinking skills by frequently exposing them to critical thinking practices (Changwong et al., 2018; Mulyono, 2018). Educators should also engage students in activities like discussions and assignments to further enhance their critical thinking skills. In this case, the learning methods employed by teachers during the learning process significantly influence students' critical thinking ability (Bastian et al., 2022). Based on the 21st-century educational paradigm, critical thinking skills are essential for students to prepare themselves for post-secondary education and the workforce (Lai, 2011).

Conclusion

The results of the questionnaire on the differences between face-to-face and online education are shown in Figure 1. Scientific lessons, particularly chemistry, incorporate practical aspects as a crucial and substantial part of the educational process for the course. While the theoretical curriculum was covered through e-learning methods, the practical component focused on fostering students' skills through hands-on laboratory experiments conducted in specialized facilities. Based on the study results, the AQ (Adversity Quotient) of Chemistry Education students can be categorized as follows: 6.7% were included in the very low category, 26.7% in the low category, 30% in the moderate category, 33.3% in the high category, and 3.3% in the very high category. The average AQ score for all indicators, including control, origin and ownership, reach, and endurance, was categorized as moderate. Regarding critical thinking ability, Chemistry Education students' frequency distribution is as follows: 6.67% were in the high category, 23.33% in the moderate category, 40% in the low category, and 30% in the very low category. Regarding the specific topic of salt hydrolysis material, students' average critical thinking skills were categorized as

low across all indicators, namely giving simple explanations, building basic skills, making conclusions, giving further explanations, and setting strategies or tactics. After conducting the product-moment correlation test, it was observed that there was no significant correlation between AQ and the critical thinking ability of Chemistry Education students on salt hydrolysis material, as the correlation significance value was 0.299.

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