

Analysis Of Understanding Of Chemical Concepts Reviewed From Intellectual Intelligence (Iq) And Adverse Resistance Intelligence (Aq)

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Abstract

Universities play an important role in the development of individuals who are skilled and ready to face challenges in the professional world. It is important to investigate the various factors that influence students' success in their educational endeavors to ensure they can reach their maximum potential. This study aims to examine the effect of intellectual intelligence (IQ) and resilience (AQ) on chemistry concept understanding (PK) among students in the Mathematics Education program. In this study, participants were randomly selected to ensure accuracy and fair representation of the student population. The data collected were analyzed using multiple regression techniques, which allow researchers to look at the relationship between multiple independent variables and the dependent variable simultaneously. The results of this study show that IQ and AQ together have a significant impact on the understanding of chemical concepts. In addition, individually, both IQ and AQ also show a significant influence on the understanding of chemical concepts. In other words, students with higher levels of intellectual intelligence and better resilience abilities tend to have a deeper understanding of chemistry concepts. These findings emphasize the importance of developing not only cognitive aspects but also non-cognitive aspects such as resilience in the educational process. This can help in designing educational programs that are more comprehensive and effective in preparing students for future academic and professional challenges.

Keywords : *Understanding Chemical Concepts, Intellectual Quotient (IQ), Resilience Quotient (AQ)*

1. Introduction

Education, especially chemistry education, plays an important role in the development of individuals and society. In chemistry education, understanding chemical concepts is the main key to achieving learning success. A good understanding of chemistry concepts allows students not only to memorize facts, but also to apply their knowledge in various situations, both in academic contexts and everyday life. In this way, students can develop a wider range of skills and improve their ability to apply chemical knowledge in various contexts (Seprianto, 2020). However, the level of understanding of chemical concepts can vary between students, and intellectual quotient (IQ) is one factor that is thought to influence this difference. IQ has long been used as an indicator of an individual's cognitive abilities which include logical, analytical and problem solving abilities. Several studies have shown that students with high IQ tend to have a better understanding of concepts. This is because IQ influences students' ability to understand and apply complex and abstract chemical concepts. However, keep in mind that IQ is not the only factor that influences understanding chemistry concepts. Other factors such as emotional, spiritual intelligence and resilience can also play a role in improving students' ability to understand chemical concepts (Nursa'adah & Rosa, 2018).

Resilience intelligence (Adversity Quotient or AQ) influences understanding of chemical concepts by measuring an individual's ability to face and overcome difficulties and challenges in the learning process. Students with high AQ are usually more resilient, able to survive in difficult situations, and tend to be more persistent in finding solutions. Thus, AQ can influence student learning outcomes, especially in chemistry subjects which are often considered difficult and require broader skill abilities (FAUZIYAH, 2022). To integrate the two aspects of intelligence, namely IQ and AQ, in the analysis of understanding chemical concepts, more specific and structured research is needed. IQ (Intelligence Quotient) and AQ (Affective Quotient) are two different concepts in psychology, with IQ measuring cognitive ability and AQ measuring affective ability. Integrating the two in an analysis of understanding chemistry

concepts can provide more comprehensive insight into the factors that influence student learning success (Baina et al., 2022).

Chemistry is a subject that many students often find challenging. The abstract and complex concepts in chemistry require strong cognitive abilities and effective learning strategies. As a result, there is significant variation in students' ability to understand chemistry material. The cause of students experiencing difficulties in learning chemistry is the lack of interest and attention of students during the learning process, as well as the lack of readiness to motivate students to study chemistry. Using monotonous teaching methods such as lectures can also make students sleepy and make them less attentive because it is boring (Prayunisa, 2022). To improve students' ability to understand chemistry, the strategy of organizing concept exercises can be seen as an alternative in conveying chemistry material. This can be seen from the increase in students' ability to think concretely from pretest to posttest with the lowest and highest scores (Mintarto & Erman, 2016).

Apart from that, the variety of learning methods used by teachers in teaching chemistry affects student achievement. Teachers can use varied and creative methods to produce students who have maximum learning achievement. This is supported by various literature that varied and creative methods will produce students who have maximum learning achievement (Herlina & Winaryati, 2017).

Within the realm of scholarly inquiry into the impact of intellectual quotient (IQ) on student scholastic performance, IQ is frequently regarded as a primary determinant of academic achievement. IQ serves as a measure of an individual's skills in critical thinking, analytical reasoning, and linguistic comprehension, all of which play a crucial role in grasping complex chemistry principles. Students with elevated IQs typically exhibit enhanced capacities for assimilating information and effectively applying chemistry principles across diverse scenarios. In relation to academic achievement, IQ is also defined as the ability to work abstractly, recognize and learn and use abstractions, and solve problems including new problems. IQ does not involve feelings or emotions in processing information, but focuses more on the ability to think, understand and analyze information to receive, store and process information into facts. On the other hand, resilience quotient (AQ) is a relatively new concept but is increasingly recognized for its importance in educational contexts. AQ measures an individual's ability to persevere and overcome challenges, which traditional IQ tests often do not accommodate. In the process of learning chemistry, students who have a high AQ may be better able to face initial failures and continue trying until they succeed in understanding difficult concepts.

This research aims to examine the relationship between IQ (Intelligence Quotient) and AQ (Adversity Quotient) with students' understanding of chemistry concepts. By understanding how these two factors contribute to conceptual understanding, it is hoped that more effective educational strategies can be found to help all students achieve better understanding in chemistry lessons. It is also hoped that this research can contribute to the development of curricula and teaching methods that take into account variations in student intelligence. This research shows that IQ and AQ have significant implications for curriculum development and teaching methods. IQ, which is usually measured through intelligence tests, influences students' ability to understand chemical concepts, as well as influencing educational goals, learning strategies, materials or materials taught, and evaluation of learning that is suitable for application with all the intellectual potential of students (Amelia et al., 2022).

AQ, which measures students' ability to withstand difficulties during learning, also influences students' learning motivation. The results of the research show that students' learning motivation that comes from within themselves, such as the desire to learn, completing assignments on time, the enjoyment of taking lessons, as well as the development of students' talents and knowledge, still needs to be improved (Gusta et al., 2022). By understanding how IQ and AQ contribute to understanding chemistry concepts, it is hoped that this research can contribute to the development of more effective curricula and teaching methods to help all students achieve a better understanding in chemistry lessons.

2. Method

This research uses quantitative research methods to analyze the relationship between intellectual quotient (IQ), resilience quotient (AQ), and students' understanding of chemical concepts. The quantitative method was chosen because it allows researchers to measure these variables objectively and analyze the data using statistical techniques. The data obtained will be analyzed using descriptive statistics and multiple regression with the research design which can be seen in the following picture:

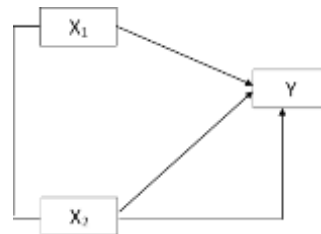


Figure 1. Research Design Design
Source: *Data Processing*

Information :

X1: Intellectual Intelligence (IQ)

X2: Adversity Resilience Intelligence (AQ)

Y: Understanding of chemical concepts

Population and Sample

The target population in this study were all students participating in basic chemistry courses in the odd semester of the 2017/2018 academic year, students in the Mathematics Education study program, Faculty of Engineering, Mathematics and Science, Indraprasta PGRI University, Jakarta. A sample is a portion of the population taken as a data source and can represent the entire population. Therefore, samples are needed to collect data that can describe the actual population situation. For sampling for this research, students who were members of the affordable population were taken randomly. Determination of this sample refers to the opinion of (Arikunto, 2010), namely that if the research object is greater than 100 respondents, 10% to 15%, or 20% to 30%, but if there are less than 100 respondents, then the entire respondent or sample is taken.

Method of collecting data

Research variable

The variables used in this research consist of 2 variables, that is

- 1) The independent variable consists of Intellectual Intelligence (IQ), and Adversity Resilience Intelligence (AQ).
- 2) Dependent variable (criterium), namely understanding chemical concepts.

Data sources

Data sources are where data can be obtained. In this research, there are two types of data collected based on The source is:

- a. Adversity Resilience Intelligence (AQ) comes from students who are research samples using questionnaires.
- b. Understanding chemical concepts and Intellectual Intelligence (IQ) sourced from description tests on sample students study.

Research Instrument

Table 1. Grid of Chemical Concept Understanding Test Instruments

No	Dimensi	No. Butir Soal	Jumlah
1.	Penerjemaham (<i>translation</i>)	1a, 1b, 2, 5a, 6a, 6b	6
2.	Penafsiran (<i>interpretation</i>)	3a, 3b, 4, 5b, 6c	5
3.	Ekstrapolasi (<i>extrapolation</i>)	5c, 7a, 7b, 8,9	5
Jumlah			16

Source: Data Processing

Table 2. Validity Test Results of the Chemical Concept Understanding Test Instrument

No. Butir	r pbis	r tabel	Keterangan	Kesimpulan
1a	0,60	0,4973	Valid	Diterima
1b	0,50	0,4973	Valid	Diterima
2	0,58	0,4973	Valid	Diterima
3a	0,66	0,4973	Valid	Diterima
3b	0,58	0,4973	Valid	Diterima
4	0,53	0,4973	Valid	Diterima
5a	0,54	0,4973	Valid	Diterima
5b	0,64	0,4973	Valid	Diterima
5c	0,63	0,4973	Valid	Diterima
6a	0,57	0,4973	Valid	Diterima
6b	0,51	0,4973	Valid	Diterima
6c	0,52	0,4973	Valid	Diterima
7a	0,77	0,4973	Valid	Diterima
7b	0,81	0,4973	Valid	Diterima
8	0,63	0,4973	Valid	Diterima
9	0,59	0,4973	Valid	Diterima

Source: Data Processing

Adversity Resilience Questionnaire (AQ) Instrument

Table 3. Accident Resistance Instrument (AQ) Instrument Grid

No	Indikator	Pernyataan		Jumlah
		+	-	
1	<i>Control</i> (Kemampuan mengendalikan peristiwa)	1, 2, 6, 11, 12, 16, 17, 24	3, 9, 26, 39, 40	13
2	<i>Origin</i> (sumber kesulitan)	28, 34, 36	5	4
3	<i>Ownership</i> (pengakuan kesalahan)	4, 10	8	3
4	<i>Reach</i> (jangkauan kesulitan terhadap kehidupan individu)	13, 27, 35	30, 37	5
5	<i>Endurance</i> (aspek ketahanan individu)	7, 14, 18, 19, 20, 21, 23, 25, 31, 33	15, 22, 29, 32, 38	15
Total		26	14	40

Source: Data Processing

Table 4. Statement Item Validity Test Results Adversity Resilience Instrument

No. Butir	r pbis	r tabel	Keterangan	Kesimpulan
1	0.95	0,4973	Valid	Diterima
2	0.97	0,4973	Valid	Diterima
3	0.86	0,4973	Valid	Diterima
4	0.96	0,4973	Valid	Diterima
5	0.87	0,4973	Valid	Diterima
6	0.96	0,4973	Valid	Diterima
7	0.96	0,4973	Valid	Diterima
8	0.86	0,4973	Valid	Diterima
9	0.94	0,4973	Valid	Diterima
10	0.96	0,4973	Valid	Diterima
11	0.96	0,4973	Valid	Diterima
12	0.89	0,4973	Valid	Diterima
13	0.93	0,4973	Valid	Diterima
14	0.88	0,4973	Valid	Diterima
15	0.83	0,4973	Valid	Diterima
16	0.95	0,4973	Valid	Diterima
17	0.91	0,4973	Valid	Diterima
18	0.96	0,4973	Valid	Diterima
19	0.97	0,4973	Valid	Diterima
20	0.94	0,4973	Valid	Diterima
21	0.93	0,4973	Valid	Diterima
22	0.93	0,4973	Valid	Diterima
23	0.83	0,4973	Valid	Diterima
24	0.92	0,4973	Valid	Diterima
25	0.98	0,4973	Valid	Diterima
26	0.87	0,4973	Valid	Diterima
27	0.94	0,4973	Valid	Diterima
28	0.92	0,4973	Valid	Diterima
29	0.95	0,4973	Valid	Diterima
30	0.91	0,4973	Valid	Diterima
31	0.97	0,4973	Valid	Diterima
32	0.96	0,4973	Valid	Diterima
33	0.83	0,4973	Valid	Diterima
34	0.79	0,4973	Valid	Diterima
35	0.89	0,4973	Valid	Diterima
36	0.82	0,4973	Valid	Diterima
37	0.83	0,4973	Valid	Diterima
38	0.82	0,4973	Valid	Diterima

Source: Data Processing

Results and Discussion

Data Description

As is known, in this research there are 3 important variables, these consist of 2 independent variables and one dependent variable. These variables are as follows:

1. Intellectual Intelligence: Variable X1

2. Adversity Resilience Intelligence: Variable X2
3. Understanding the Concept: Variable Y

Intellectual Intelligence Data (X1)

Table 5. Data Description

		Statistics				
		IQ	EQ	SQ	AG	PK
N	Valid	77	77	77	77	77
	Missing	0	0	0	0	0
Mean		76.86	176.55	180.47	117.36	75.82
Median		78.00	181.00	188.00	117.00	76.00
Mode		87	200	170 ^a	110	80
Std. Deviation		10.952	27.060	26.414	10.570	10.011
Variance		119.940	732.226	697.673	111.734	100.230
Skewness		.216	-.654	-1.065	.499	-.162
Std. Error of Skewness		.274	.274	.274	.274	.274
Kurtosis		1.696	-.181	1.041	-.418	-.211
Std. Error of Kurtosis		.541	.541	.541	.541	.541
Range		71	123	120	42	50
Minimum		44	92	100	100	47
Maximum		115	215	220	142	97
Sum		5918	13594	13896	9037	5838

a. Multiple modes exist. The smallest value is shown

Source: Data Processing

Based on table 5. above, an average score of 76.86 was obtained with a standard deviation of 10.952, a median of 78, a minimum score of 44 and a maximum score of 115. These findings indicate that the data for the Intellectual Intelligence variable is quite varied. Thus it can be said that students' Intellectual Intelligence has various characteristics.

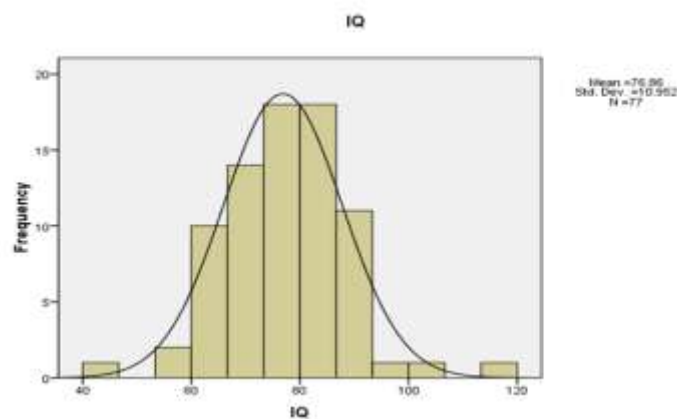


Figure 2. Polygon histogram of Distribution of Variable X1

Source: Data Processing

Based on histogram graph 2. above, it can be concluded that Intellectual Intelligence in this study has a distribution that tends to be normal.

Data on Adversity Resilience Intelligence (X2)

Based on table 5 above, an average score of 117.36 was obtained with a standard deviation of 10.570, a median of 117, a minimum score of 100 and a maximum score of 142. These findings indicate that the Concept Understanding variable data is quite varied. Thus, it can be said that students' creative thinking abilities, intelligence, adversity resilience have different or varied characteristics.

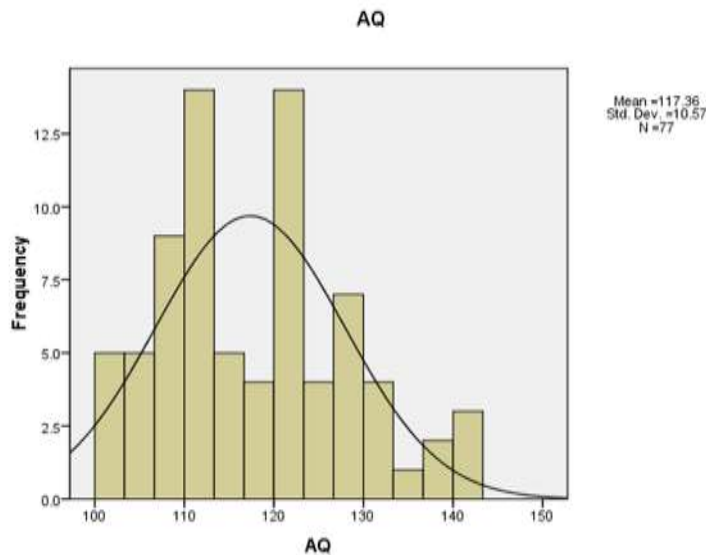


Figure 3. Adversity Resilience Intelligence polygon histogram (X2)
Source: Data Processing

Based on the histogram graph 3. above, it can be concluded that the Adversity Resilience Intelligence in this study has a distribution that tends to be normal.

Concept Understanding Data (Y)

Based on table 5 above, an average score of 75.82 was obtained with a standard deviation of 10.011, a median of 76, a minimum score of 47 and a maximum score of 97. These findings indicate that the Concept Understanding variable data is quite varied. Thus, it can be said that students' conceptual understanding has different or varied achievement characteristics.

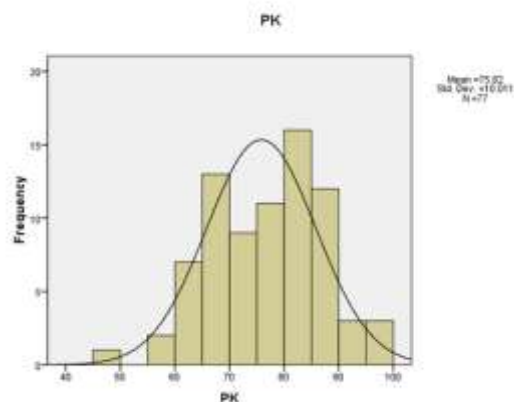


Figure 4. Concept Understanding polygon histogram
Source: Data Processing

Based on histogram graph 4. above, it can be concluded that Concept Understanding in this study has a distribution that tends to be normal.

Uji Normalitas

Table 6. Normality test

One-Sample Kolmogorov-Smirnov Test						
		IQ	EQ	SQ	AQ	PK
N		77	77	77	77	77
Normal Parameters ^a	Mean	76.86	176.55	180.47	117.36	75.82
	Std. Deviation	10.952	27.060	26.414	10.870	10.011
Most Extreme Differences	Absolute	.076	.135	.150	.147	.103
	Positive	.076	.135	.084	.147	.058
	Negative	-.064	-.132	-.150	-.056	-.103
Kolmogorov-Smirnov Z		.668	1.188	1.319	1.286	.908
Asymp. Sig. (2-tailed)		.764	.119	.062	.073	.382

a. Test distribution is Normal.

Source: Data Processing

Uji Linearitas

Table 7. Test Results for Linearity of Intellectual Intelligence Variable (X1) towards Concept Understanding (Y)

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
PK * IQ	Between Groups	(Combined)	7226.038	32	225.814	25.384	.000
		Linearity	6779.201	1	6779.201	762.065	.000
		Deviation from Linearity	446.837	31	14.414	1.620	.070
	Within Groups		391.417	44	8.896		
Total		7617.455	76				

Source: Data Processing

Table 8. Results of the Test for Linearity of the Misfortune Resilience Intelligence Variable (X2) towards Concept Understanding (Y)

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
PK * AQ	Between Groups	(Combined)	6816.605	28	243.450	14.592	.000
		Linearity	6405.220	1	6405.220	383.906	.000
		Deviation from Linearity	411.385	27	15.236	.913	.592
	Within Groups		800.850	48	16.684		
Total		7617.455	76				

Source: Data Processing

Uji Multikolinieritas

Coefficients ^a											
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error				Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	-10.343	2.358		-4.387	.000					
	IQ	.252	.046	.275	5.418	.000	.343	.538	.103	.140	7.148
	EQ	.145	.019	.393	7.821	.000	.951	.678	.149	.143	6.989
	SQ	.020	.009	.054	2.321	.023	.587	.264	.044	.566	1.502
	AQ	.319	.034	.337	9.333	.000	.317	.740	.177	.277	3.616

a. Dependent Variable: PK

Source: Data Processing

Hypothesis test

Hypothesis testing uses multiple regression, the data used in this research is Intellectual Intelligence (X1), and Adversity Resilience Intelligence (X2) and Concept Understanding (Y).

Table 9. Correlation Coefficient Calculation Results Influence of Variables X1, X2, on Y

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.987 ^a	.974	.973	1.658

a. Predictors: (Constant), AQ, SQ, EQ, IQ

Source: Data Processing

Table 10. Recapitulation of Calculation Results of Regression Coefficient Significance Testing on the Effect of Variables X1, X2 on Y

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7419.465	4	1854.866	674.531	.000 ^a
	Residual	197.990	72	2.750		
	Total	7617.455	76			

a. Predictors: (Constant), AQ, SQ, EQ, IQ

b. Dependent Variable: PK

Source: Data Processing

Table 11. Recapitulation of Regression Line Equation Calculation Results Influence of Variables X1, X2 on Y

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-10.343	2.358		-4.387	.000
	IQ	.252	.046	.275	5.418	.000
	EQ	.145	.019	.393	7.821	.000
	SQ	.020	.009	.054	2.321	.023
	AQ	.319	.034	.337	9.333	.000

a. Dependent Variable: PK

Source: Data Processing

Discussion of Research Results

Based on table 5 above, it can be seen that the multiple correlation coefficient of the influence of the independent variables Intellectual Intelligence, Emotional Intelligence, Spiritual Intelligence and Misfortune Resilience Intelligence together on Concept Understanding is 0.987. From these calculations it was found that the correlation coefficient was significant, in other words that there was an influence of Intellectual Intelligence (IQ) and Adversity Resilience Intelligence (AQ) together on concept understanding. Meanwhile, the coefficient of determination is 97.4%, indicating that the contribution of Intellectual Intelligence, Emotional Intelligence, Spiritual Intelligence and Adversity Resilience Intelligence together to Concept Understanding, the remaining 2.6% is due to the influence of other factors.

The success of a person's work and life is largely determined by AQ. Someone who has a higher AQ does not easily blame other parties for the problems they face but instead takes responsibility for solving the problem. They don't complain easily and don't give up easily no matter how bad the conditions are. On the contrary, with all their limitations, they are able to think, act and work around themselves to move forward. On the other hand, a person's low AQ is a blunting of survival. Complains all day when facing problems and finds it difficult to see the wisdom behind all the problems he faces.

Chemistry has a unique characteristic, namely that it is related to abstract ideas that are given symbols. Some students think basic chemistry is a difficult subject because there are many abstract concepts contained in chemistry. This is where the potential of AQ is really needed in studying chemistry. Learning is basically overcoming difficulties. Experiencing difficulties means that someone is still given the opportunity to hone their sensitivity, sharpness of mind and intelligence. Isn't someone surviving until now, one of the reasons is because they have faced many life challenges in the past.

4. Conclusion

IQ has a significant positive correlation with understanding chemical concepts. This means that students with higher IQ tend to have better abilities in understanding chemical concepts. This is because IQ is related to analytical, logical and problem-solving abilities, which are very necessary in studying chemistry. AQ also shows a positive correlation with understanding chemical concepts. Students with high AQ have a better ability to face difficulties and challenges in learning. They are more resistant to failure and more persistent in solving complex chemical problems. The combination of high IQ and AQ provides the best results in understanding chemical concepts. Students who have these two types of intelligence are not only able to understand concepts quickly (because of high IQ) but are also able to survive and adapt when facing learning difficulties (because of high AQ). An effective learning program should include exercises and activities that stimulate both intelligences. For example, using case studies or real problems that require in-depth analysis (to develop IQ) as well as providing challenging tasks that require persistence and resilience (to develop AQ).

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