

Linking Emotional Intelligence to Cognitive Load Management In Biology

Sitiawati Mulyanah¹, Romy Faisal Mustofa^{2*}, Mufti Ali³

Department of Biology Education, Faculty of Teacher Training and Education, Siliwangi University, Jl. Siliwangi No.24, Kahuripan, Kec. Tawang, Kab. Tasikmalaya, Jawa Barat 46115

¹ sitiawatimlynh.1402@gmail.com ; ²syahla.aini@unsil.ac.id ; ³muftiali@unsil.ac.id

* Corresponding author: syahla.aini@unsil.ac.id

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ABSTRACT

21st-century education highlights the importance of understanding cognitive load and emotional intelligence in the context of teaching and learning. This study aims to determine the correlation between emotional intelligence and cognitive load of students in biology subjects in *Class XI MIPA SMAN 4 Tasikmalaya*. The respondent is *XI MIPA SMAN 4 Tasikmalaya*, consisting of 5 classes with 190 students. The research respondents were taken using total sampling, where the entire population becomes the sample. The research instrument uses a 44-statement emotional intelligence questionnaire and a 20-statement cognitive load questionnaire. The data analysis technique used is simple correlation testing, namely, bivariate. The study results show a robust correlation between emotional intelligence and cognitive load, with a coefficient (R) of 0.972. The emotional intelligence variable contributes 94.4% to the cognitive load, as indicated by the coefficient of determination (R²) of 0.944. This research concludes that there is a significant correlation between emotional intelligence and the cognitive load of students in biology subjects in *Class XI SMA Negeri 4 Tasikmalaya*.

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Keywords: Biology; Cognitive load; Correlation; Emotional intelligence

Introduction

Emotional intelligence (EQ) among students has become an increasingly important educational research. This is due to the understanding that academic success is determined by intellectual intelligence (IQ) and the ability to manage emotions and interpersonal relationships. Measurement in defining and achieving students' academic achievements generally focuses on cognitive aspects, especially intellectual intelligence (IQ). IQ becomes the main factor in assessing students' thinking abilities and is considered a key element in classifying intelligence levels ([Craggs, 2005](#)). A student has three types of intelligence that can be effectively utilized if managed optimally ([Labola, 2018](#)). The intelligences referred to are intelligence quotient (IQ), emotional quotient (EQ), and spiritual quotient (SQ). With the evolution of research, many experts nowadays highlight that the role of intellectual intelligence (IQ) in an individual's learning achievement is minimal. The highest contribution of IQ is only about 20% to the factors determining success, while the remaining 80% comes from other factors defining success in life ([Emotionally & Workplace, 1990](#)). Therefore, many scientists endeavor to identify different aspects of intelligence that are considered more essential. Emotional intelligence is the ability to recognize one's feelings and the feelings of others and manage emotions well in oneself and others ([Goleman, 2000](#)). Emotional intelligence is the ability to effectively use emotions to achieve goals, build productive correlations, and attain success ([Mirnawati & Basri, 2018](#)). Emotional intelligence is a set of personality, emotional, and social abilities that influence a person's capacity to cope with environmental demands and pressures ([Goleman, 2006](#)).

John Sweller first developed cognitive load in the 1980s. Sweller argued that the theory of cognitive load is related to difficulties in the learning process and problem-solving, in line with Sweller's statement ([Lesmana Sari, Ramdhan, & Windyariani, 2020](#)), each individual can process information because, the working memory of each individual has limited capacity related to the time when receiving new information ([Fraser, Ayres, & Sweller, 2015](#)). Working memory is where most of the actual cognitive processes take place ([Ormrod, 2009](#)). It indicates that individual working memory is limited, meaning people cannot handle much information simultaneously. This is due to the limited working memory capacity, which can only accommodate a certain number of elements. Students who receive too much information will have difficulty processing information during the learning process. This is known as cognitive load, addressing the limitations of working memory in processing new information ([Sweller, 2010](#)). Students who feel anxious or stressed may experience difficulty processing information effectively, thereby increasing working memory and perceived academic stress.

Emotional intelligence helps students manage cognitive load by regulating emotions and reducing stress ([Oktarisa, Dessyrianti, Deviona, & Wilda, 2023](#)). Poor emotion control disrupts self-awareness and learning motivation ([Mustofa, Rachmawati, & Nuryadin, 2022](#)). Cognitive load is influenced by material complexity, learning environment, and self-efficacy ([Nurwanda et al., 2020](#)), making time management crucial ([Nabiila & Mustofa, 2020](#)).

Previous relevant research conducted by [Young et al. \(2021\)](#) shows positive effects on emotion and cognitive load. [Mustofa et al. \(2022\)](#) indicates a moderate correlation between emotional intelligence and self-regulated learning. Research suggests that the higher students' emotional intelligence, the higher their learning outcomes ([Surahman, Hernawati, & Biologi, 2022](#)). Research shows a positive relationship between learning interest and cognitive load, supported by a correlation coefficient with a significance value of 0.050 ([Pramudiyan & Fadhillah, 2024](#)). Academic stress can affect cognitive load, stating that stress may increase cognitive load and reduce task efficiency ([Plass & Kalyuga, 2019](#)). Previous research has primarily focused on three indicators of emotional intelligence. In comparison, the five indicators emphasized by Goleman have not been extensively studied, and research on emotional intelligence's impact on cognitive load has not been deeply explored. This variable

provides an opportunity for further research on the correlation between emotional intelligence and cognitive load in biology subjects.

While teacher interviews highlight student tendencies toward delayed submissions and absenteeism, direct interviews with students reveal self-reported challenges in maintaining consistent engagement, particularly in opinion-driven discussions. Many perceive the demands as excessive, causing stress and academic anxiety. These issues suggest deficiencies in emotional intelligence and self-regulation. Emotional intelligence enables effective emotion management ([Oktarisa et al., 2023](#)), reduces stress-induced cognitive overload ([Arsy & Annisa, 2022](#)), and fosters self-awareness ([Sulastri, Yuline, & Purwanti, 2022](#)). Balanced emotional expression and time management are critical ([Mustofa et al., 2022](#)), as cognitive load varies with task complexity, environment, and self-efficacy ([Nurwanda et al., 2020](#)). This study aims to determine the correlation between emotional intelligence and cognitive load of students in biology subjects in Class XI MIPA SMAN 4 Tasikmalaya.

Methods

This study was conducted at SMA Negeri 4 Tasikmalaya. The type of research used in this study was correlational quantitative research. The correlational method in this research determines the correlation between students' Emotional Intelligence and Cognitive Load. The variables in this study consisted of the dependent variable, cognitive load, and the independent variable, emotional intelligence. The respondents in this study were the Class XI MIPA SMA Negeri 4 Tasikmalaya, with a total of 190 students. This research technique uses total sampling.

The research data was collected using a non-test instrument, namely a questionnaire. The instruments in this study consist of two questionnaires: the emotional intelligence questionnaire from Goleman, with 44 statements. Each statement is rated using a Likert scale of one to four, with details as follows: strongly agree (4), agree (3), disagree (2), and strongly disagree (1). Additionally, the cognitive load questionnaire developed by Leppink comprises 20 statements rated on a Likert scale ranging from 0 to 10, with response options spanning from 'cannot' to 'very high'. Before applying bivariate regression correlation tests, it is essential to conduct prerequisite analysis, including normality and linearity testing. Normality testing ensures that the data used in the study has a normal distribution. In contrast, linearity testing is used to verify that the correlation between the independent variable and the dependent variable is linear. By fulfilling these prerequisites, the bivariate regression correlation test results can be interpreted more accurately and validly.

Results and Discussion

The analysis reveals a statistically significant correlation between emotional intelligence and cognitive load, with a p -value of 0.000. The correlation coefficient ($R = 0.972$) indicates a strong negative correlation, while the coefficient of determination ($R^2 = 0.944$) demonstrates that emotional intelligence accounts for 94.4% of the variance in cognitive load. The remaining 5.6% may be attributed to unexamined variables.

See Table 1 (regression summary) and Table 2 (t-test coefficients) for detailed results. The regression model (Table 1) shows an adjusted R^2 of 0.944 ($F = 3183.952$; $df = 1, 188$; $p < 0.001$), confirming the explanatory power of emotional intelligence. Further, the t-test results (Table 2) reveal that emotional intelligence significantly predicts cognitive load ($\beta = -2.058$, $p < 0.001$), with higher emotional intelligence associated with lower cognitive load.

Table 1. Summary of Regression Results of Emotional Intelligence Bivariate Correlation with Cognitive Load

Model Summary ^b									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.972 ^a	.944	.944	6.230	.944	3183.952	1	188	.000

a. Predictors: (Constant), emotional intelligence

b. Dependent Variable: cognitive load

Table 2. Summary of Emotional Intelligence t Test with Cognitive load

Coefficients ^a					
Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	
	B	Beta			
1 (Constant)	379.140		77.380	.000	
emotional intelligence	-2.058	-.972	-56.444	.000	

a. Dependent Variable: cognitive load

Table 2 shows the regression equation $Y' = a + bx$. The value of a is 379.140, and the value of b for x1 is -2.058. Thus, the obtained regression equation is $Y' = 379.140 - 2.058x$.

The results of the study conducted in Class XI SMA Negeri 4 Tasikmalaya show that the data were tested using the Pearson bivariate regression correlation test with the assistance of SPSS version 25 for Windows. The regression analysis results indicate a significant correlation between emotional intelligence and cognitive load, with a significance value of 0.0000. The results of the simple correlation test show a coefficient R of 0.972, indicating that emotional intelligence and cognitive load have a very strong correlation. Furthermore, the regression analysis results show a coefficient of determination R² of 0.944 or 94.4%, indicating that the emotional intelligence variable contributes 94.4% to the cognitive load. The remaining 5.6% represents other variables not examined in this study. For further details on the analysis results, the results of each variable indicator can be seen in Figures 2 and 3.

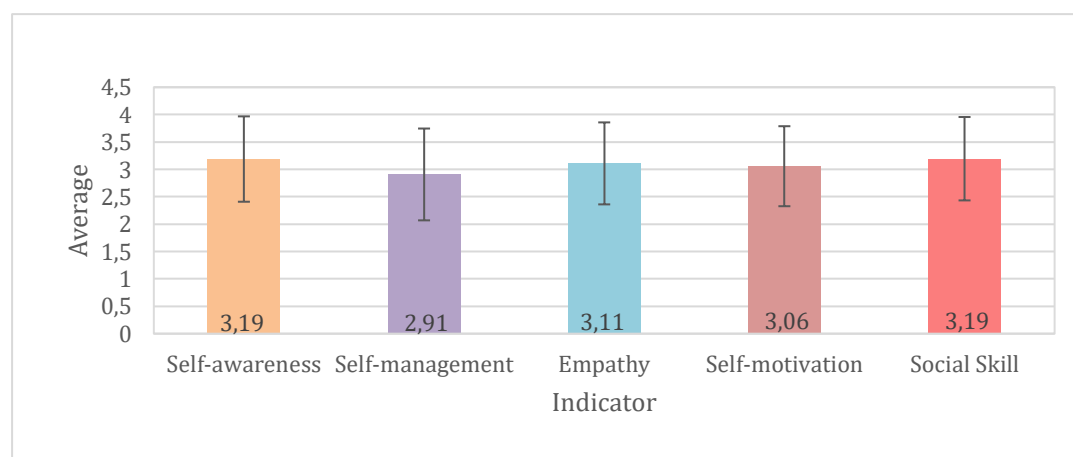


Figure 2. Average Students' Emotional Intelligence Questionnaire Scores on Each Goleman Indicator Class XI MIPA SMA Negeri 4 Tasikmalaya

Figure 2 lists the total scores per indicator on emotional intelligence. The highest scores are found in the self-awareness and social skill indicators, with an average score of 3.19 based on the overall average per indicator. Meanwhile, the lowest score is found in the second indicator, self-motivation, with an average score of 2.91 based on the overall average per indicator.

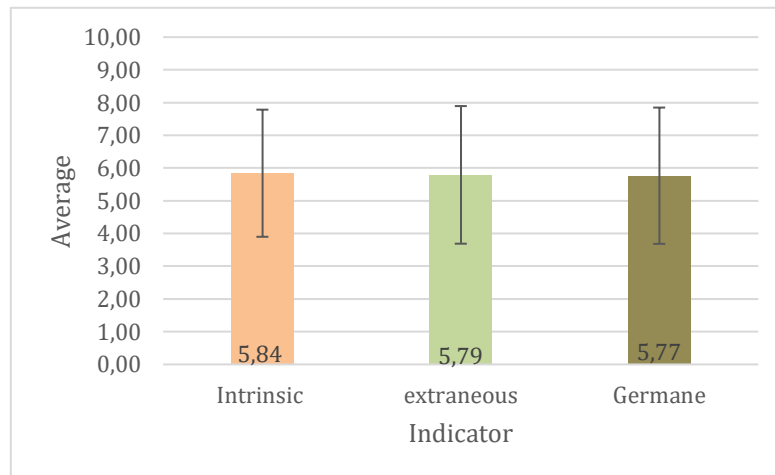


Figure 3. Average Students' Cognitive Load Questionnaire Scores on Each Swaller Indicator Class XI MIPA SMA Negeri 4 Tasikmalaya

Figure 3 shows the average scores for each indicator of cognitive load. Based on the research conducted on 190 students, the intrinsic cognitive load indicator has the highest average score, 5.84 out of all cognitive load indicators. These results indicate that students' reception of the complexity of the biology subject matter is not optimal. This occurs when the cognitive process in students' working memory is hindered because students require a more profound understanding to learn biology's concepts and scientific terms. Considering the subject matter, biology is less observable because most concepts in biology are related to processes or structures that cannot be directly observed or are too small to be observed with the naked eye. As a result, the intrinsic load on students in biology is relatively high.

Based on the research conducted in Class XI MIPA at SMA Negeri 4 Tasikmalaya, bivariate regression analysis (SPSS 25 for Windows) yielded a significance value (p) of 0.000. Using a 5% significance level ($\alpha = 0.05$), the null hypothesis (H_0) was rejected because $p \leq \alpha$ ($p = 0.000 \leq 0.05$). This result confirms a statistically significant correlation between emotional intelligence and cognitive load.

The regression analysis yielded the equation: $Y' = 379.140 - 2.058X$. The negative regression coefficient (-2.058) indicates an inverse correlation between emotional intelligence and cognitive load, where every 1-unit increase in emotional intelligence score corresponds to a 2.058-unit decrease in cognitive load. The constant value (379.140) represents the baseline cognitive load when emotional intelligence is zero. These findings align with [ALmegeewly et al. \(2022\)](#) research demonstrating the significant role of emotional intelligence in cognitive processes, though in a different context: while their study revealed a positive effect on academic achievement, our research demonstrates explicitly its reducing effect on cognitive load. This complementary correlation suggests that higher emotional intelligence alleviates students' mental burden during learning processes.

Existing research consistently demonstrates an inverse correlation between emotional intelligence and cognitive load. Our findings confirm this pattern, showing that students with higher emotional intelligence experience significantly reduced cognitive load. This aligns with [Surahman et al \(2022\)](#), who found that improved emotional intelligence correlates with better learning outcomes - suggesting that reduced cognitive load may mediate this positive

academic effect. The negative correlation is further supported by [Wahyuni & Cahyani \(2021\)](#), whose work established that:

1. High emotional intelligence $\leftrightarrow$ Low cognitive load (negative correlation)
2. Low emotional intelligence $\leftrightarrow$ High cognitive load (positive correlation)

These correlations underscore how emotional intelligence serves as a crucial educational factor. As [Likamulyanti \(2020\)](#) notes, emotional intelligence not only facilitates learning engagement but also enhances cognitive capacity by optimizing cognitive resource allocation - an effect reflected in our strong negative correlation ($r = -0.972$, $p < .001$).

These findings underscore educators' importance in recognizing individual differences in emotional intelligence and cultivating learning environments that foster these competencies. Our analysis demonstrates that higher emotional intelligence (X) leads to reduced cognitive load (Y), as evidenced by the negative regression coefficient ($\beta = -2.058$, $p < .001$). This inverse correlation suggests that targeted emotional intelligence development can create more inclusive and effective biology learning experiences.

Students with elevated emotional intelligence - as measured by their ability to regulate personal and interpersonal emotions ([Romano, Tang, Hietajärvi, Salmela-Aro, & Fiorilli, 2020](#))- benefit from significantly lower cognitive demands during learning. This aligns with our established negative correlation ($r = -0.972$), where:

- Emotional intelligence $\uparrow \rightarrow$ Cognitive load $\downarrow$ (negative association)
- Emotional intelligence $\downarrow \rightarrow$ Cognitive load $\uparrow$ (positive association)

In line with the research of [Lim & Birney \(2021\)](#), as task load increases, emotional intelligence accuracy decreases, and conversely, as task load decreases, emotional intelligence accuracy increases. [Lestari et al \(2022\)](#) suggested that individuals can be considered to have high self-awareness if they can express their emotions effectively.

Based on the explanations above, there is a negative correlation between emotional intelligence and students' cognitive load. This negative correlation means that students with higher emotional intelligence tend to experience a lower cognitive load. The correlation between emotional intelligence and cognitive load has a coefficient (R) of -0.972, indicating a strong inverse relationship between the two variables. Additionally, the R² value of 0.944 suggests that emotional intelligence explains 94.4% of the variance in cognitive load. The remaining 5.6% may be influenced by factors not examined in this study, such as resilience, stress management, individual differences, behavior, and self-efficacy.

Conclusion

This study substantiates a significant inverse correlation between emotional intelligence and cognitive load among class XI MIPA students at SMA Negeri 4 Tasikmalaya, as demonstrated through comprehensive data analysis. The findings establish emotional intelligence as a substantial determinant of cognitive load, wherein elevated emotional competence correlates with diminished cognitive strain during learning processes. This robust negative correlation positions emotional skill cultivation as a critical mediator in alleviating cognitive demands within academic settings. The implications of these findings advocate for the systematic incorporation of emotional competence development into pedagogical strategies for biology education to enhance cognitive functioning. Subsequent investigation would benefit from examining complementary variables, including psychological resilience, stress regulation mechanisms, and self-efficacy belief, to further elucidate the multifaceted nature of cognitive load phenomena in educational contexts.

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