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The Role of Emotional and Spiritual Intelligence in Students' Physics Learning Achievement

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Abstract

This study aims to examine the extent to which emotional intelligence and spiritual intelligence influence students' physics learning outcomes at the senior high school level. A quantitative approach with a correlational design was employed. The population comprised 124 twelfth-grade students from a public senior high school in Banjarmasin, Indonesia, with a sample of 60 students selected through purposive sampling. Data on emotional and spiritual intelligence were collected using structured questionnaires, while physics learning outcomes were obtained from students' first-semester report card grades for the 2024/2025 academic year. Multiple linear regression analysis was conducted using SPSS version 22. The findings indicate that emotional intelligence and spiritual intelligence simultaneously exert a statistically significant effect on physics learning outcomes ($F = 12.831$; $p < 0.05$). The coefficient of determination ($R^2 = 0.310$) suggests that both variables account for 31% of the variance in students' physics achievement. Partially, emotional intelligence demonstrates a stronger contribution ($\beta = 0.390$; $p = 0.002$) compared to spiritual intelligence ($\beta = 0.262$; $p = 0.036$). These results highlight the meaningful role of non-cognitive factors, particularly emotional intelligence, in supporting academic achievement in physics. The study provides empirical support for considering emotional and spiritual dimensions as complementary factors in physics instruction, while acknowledging the methodological and sampling limitations inherent in the research design.

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INTRODUCTION

Physics learning is frequently perceived as an academic domain that demands advanced cognitive processing while simultaneously posing emotional challenges for students. The abstract nature of its concepts, the extensive use of mathematical representations, and the complexity of problem-solving tasks often give rise to anxiety, frustration, and diminished learning motivation (Dávila-Acedo et al., 2021; Magfirah, 2024; Pasigon, 2022). Such conditions suggest that success in physics education cannot be attributed solely to intellectual capacity. Rather, it is also shaped by non-cognitive dimensions, particularly Emotional Intelligence (EI) and Spiritual Intelligence (SI) (Tato et al., 2023; Zhou et al., 2024).

A growing body of meta-analytical and systematic review studies consistently reports a positive association between emotional intelligence and academic achievement across educational levels (Quílez-Robres et al., 2023; Sánchez-Álvarez et al., 2020; Shengyao et al., 2024). Empirical evidence further indicates that EI contributes to academic success by

enhancing self-regulation, learning motivation, and self-efficacy (Amponsah et al., 2024; Hendra et al., 2024). Even within primary education settings, emotional intelligence has been shown to correlate positively with students' academic performance (Al-Qadri & Zhao, 2021).

Within science education, students' emotional states—such as anxiety, interest, and perseverance—directly influence their problem-solving abilities and the overall quality of learning outcomes. Several studies also demonstrate that both EI and SQ foster a more positive learning climate and are associated with improved academic performance (Rosadi, 2023; Suwardi et al., 2021; Zhou et al., 2024). Collectively, these findings underscore the importance of strengthening emotional and spiritual dimensions as integral components of successful learning, particularly in cognitively demanding subjects such as physics.

From a theoretical perspective, EI refers to an individual's capacity to recognize, understand, and regulate personal emotions while responding appropriately to the emotions of others. The foundational model proposed by Salovey and Mayer (1990) and later popularized by Goleman (1995) highlights key dimensions such as self-awareness, emotional regulation, motivation, empathy, and social skills (Antonopoulou, 2024; Maitrianti, 2021). In the present study, EI is operationalized through five principal aspects: recognizing one's own emotions, managing emotions, self-motivation, empathizing with others, and maintaining social relationships. These components are particularly relevant to physics learning, which requires effective management of academic pressure, persistence in solving complex problems, and collaborative engagement in discussion-based activities (Amponsah et al., 2024; Javaid et al., 2024).

SQ, on the other hand, is conceptualized as the individual's capacity to construct meaning, values, and life purposes that guide actions and decisions. In educational contexts, SQ contributes to the development of intrinsic motivation, resilience in the face of challenges, and a more purposeful orientation toward learning (Suwardi et al., 2021; Zhou et al., 2024). In this study, spiritual intelligence is contextualized within a religious dimension encompassing worship practices, belief systems, knowledge, moral conduct, and interpersonal relationships. These dimensions are viewed as value-based foundations that shape positive attitudes, learning consistency, and students' psychological endurance when encountering the demands of physics instruction.

Within the Indonesian context, research on EI and SQ has predominantly focused on mathematics education (Aljura et al., 2024; Imamuddin et al., 2023) or general academic achievement (Suwardi et al., 2021), while studies explicitly examining physics learning remain relatively limited. This gap is noteworthy, given that physics is frequently perceived as a subject characterized by a high level of difficulty (Amalissholeh et al., 2023; Vuztasari et al., 2024), substantial cognitive demands, and the potential to trigger academic anxiety. Accordingly, investigating the roles of EI and SQ in senior high school physics learning is both timely and relevant. The findings of this study are expected to contribute empirical evidence that addresses this gap and to offer practical implications for educators in designing more holistic instructional approaches—ones that foster not only cognitive development but also students' emotional and spiritual growth.

Previous research in physics education also reveals methodological limitations. Some studies have emphasized instructional processes without quantitatively examining the simultaneous contribution of both variables, while others have relied on descriptive approaches that do not fully explain the relative strength of each factor's influence (Rivani et al., 2022; Widyawati et al., 2024). Although international meta-analyses confirm a positive association between EI, SQ, and academic achievement, their specific empirical application within physics learning in Southeast Asian contexts remains underexplored (Quílez-Robres et al., 2023; Zhou et al., 2024).

In light of these considerations, the significance of emotional and spiritual intelligence in physics learning warrants further investigation. This study, therefore, seeks to address the following research questions: (1) Does emotional intelligence significantly influence students' physics learning outcomes? (2) Does spiritual intelligence significantly influence students' physics learning outcomes? and (3) To what extent do emotional and spiritual intelligence simultaneously predict students' physics learning outcomes?

This study offers several points of novelty. First, it conceptualizes emotional intelligence and spiritual intelligence as two distinct yet complementary constructs, rather than merging them into a single composite variable. Second, it examines both the partial and simultaneous effects of these constructs on physics learning outcomes using multiple regression analysis. Third, it focuses specifically on senior high school physics learning within the Indonesian context, thereby providing contextually grounded empirical insights for the advancement of holistic science education

METHODS

This study employed a quantitative approach with a correlational design to examine the contribution of emotional intelligence and spiritual intelligence to students' physics learning outcomes. The research model incorporated two independent variables—emotional intelligence (X_1) and spiritual intelligence (X_2)—and one dependent variable, namely physics learning outcomes (Y).

The study was conducted during the first semester of the 2024/2025 academic year at a public senior high school in Banjarmasin, Indonesia. The population comprised all twelfth-grade students enrolled in physics, totaling 124 individuals. A sample of 60 students was selected using purposive sampling. The selection was based on two criteria: (1) students had completed physics instruction in the previous semester, and (2) complete first-semester physics report card grades were available for analysis. These criteria were established to ensure data relevance and completeness.

Data were collected using two primary sources. The first consisted of questionnaire instruments measuring emotional intelligence and spiritual intelligence. The emotional intelligence instrument was adapted from Ulmi (2021) and included 20 items representing five indicators: (1) recognizing personal emotions, (2) managing personal emotions, (3) self-motivation, (4) empathy toward others, and (5) relationship management. Each indicator was represented by four Likert-scale items. The spiritual intelligence instrument, developed by Rahmania (2019), also comprised 20 items distributed across five indicators: (1) worship practices, (2) belief, (3) knowledge, (4) moral conduct, and (5) interpersonal relations. In previous applications, this instrument demonstrated good internal consistency, with a reported Cronbach's Alpha coefficient of 0.886. The instruments were employed in the present study with consideration of their contextual suitability and the characteristics of the respondents. The second data source consisted of students' physics learning outcomes, obtained from official first-semester report card grades for the 2024/2025 academic year.

Data analysis was performed using SPSS version 22. The analysis began with testing the assumptions of multiple regression, including residual normality, multicollinearity, and heteroscedasticity. After confirming that the assumptions were satisfied, hypothesis testing was conducted through multiple linear regression analysis using the following model:

$$Y = a + b_1X_1 + b_2X_2 \quad (1)$$

Partial effects were examined using t-tests to determine the influence of each independent variable on physics learning outcomes, while the simultaneous effect was assessed using the F-test. The coefficient of determination (R^2) was calculated to estimate

the extent to which emotional intelligence and spiritual intelligence collectively explained the variance in students' physics achievement

RESULT AND DISCUSSION

The findings are presented in two main sections: descriptive analysis and inferential analysis. The descriptive statistics provide an overview of the characteristics of students' physics achievement, emotional intelligence, and spiritual intelligence. The inferential analysis subsequently examines the influence of emotional intelligence and spiritual intelligence on physics learning outcomes, both simultaneously and partially, following confirmation of the regression assumptions

Descriptive Analysis

The descriptive analysis provides an overview of the distribution and central tendencies of physics learning outcomes, emotional intelligence, and spiritual intelligence among the participants.

Physics Learning Achievement

The descriptive statistics for students' physics achievement are presented in Table 1.

Table 1 Students' physics learning achievement data

Description	Score
Number of samples	60
Maximum score	97
Minimum score	80
Mean	90.75
Median	90
Standard deviation	4.06
Range	17
Variance	6.52

As shown in Table 1, the mean physics score of 90.75 indicates that overall academic performance was at a high level. The relatively small standard deviation (SD = 4.06) suggests limited variability among students, reflecting a relatively homogeneous distribution of achievement.

The categorical distribution of physics learning outcomes is presented in Table 2.

Table 2 Classification of students' physics learning achievement

Score Range	Category	Frequency	Percentage
90 – 100	Very high	46	76.7%
80 – 89	High	14	23.3%
65 – 79	Moderate	0	0%
55 – 64	Low	0	0%
0 – 54	Very low	0	0%

The majority of students (76.7%) were classified in the very high category, while the remaining 23.3% were in the high category. No participants fell into the moderate or lower categories. These findings indicate that physics achievement within the sample was consistently strong.

Emotional Intelligence

The descriptive statistics for emotional intelligence are displayed in Table 3.

Table 3 Students' emotional intelligence data

Description	Value
Number of samples	60
Maximum score	78
Minimum score	36
Mean	61.63
Median	63
Standard deviation	7.61
Range	42
Variance	57.87

The mean emotional intelligence score (M = 61.63) indicates that students generally demonstrated a relatively good level of emotional competence. The standard deviation (SD = 7.61) suggests moderate individual differences, though without extreme dispersion.
The categorical distribution is shown in Table 4

Table 4 Classification of students' emotional intelligence

Emotional Intelligence Score	Category	Frequency	Percentage
68 – 80	Very high	13	21.7%
56 – 67	High	38	63.3%
44 – 55	Moderate	8	13.3%
32 – 43	Low	1	1.7%
20 – 31	Very low	0	0%

Approximately 85% of students were classified within the high or very high categories, indicating that most participants demonstrated well-developed emotional regulation, self-motivation, empathy, and interpersonal skills.

Spiritual Intelligence

The descriptive statistics for spiritual intelligence are presented in Table 5.

Table 5 Students' spiritual intelligence data

Description	Value
Number of samples	60
Maximum score	80
Minimum score	35
Mean	64
Median	64
Standard deviation	8.37
Range	45
Variance	70.10

The mean score of 64 indicates that students' spiritual intelligence was generally at a good level. The moderate standard deviation (SD = 8.37) reflects individual differences in the internalization of values, meaning orientation, and spiritual awareness.
The categorical distribution is displayed in Table 6.

Table 6 Classification of students' spiritual intelligence

Spiritual Intelligence Score	Category	Frequency	Percentage
68 – 80	Very high	22	36.7%
56 – 67	High	29	48.3%
44 – 55	Moderate	8	13.3%
32 – 43	Low	1	1.7%
20 – 31	Very low	0	0%

Similar to emotional intelligence, 85% of students were categorized as high or very high in spiritual intelligence. Overall, the three variables examined in this study exhibited favorable distributions. Nevertheless, to determine the predictive relationships among these variables, inferential statistical analysis was conducted.

Inferential Analysis

Regression Assumption Testing

Prior to conducting multiple linear regression analysis, classical assumption tests were performed to ensure that the estimated model met statistical requirements. Satisfying these assumptions is essential to obtain unbiased parameter estimates and to allow accurate interpretation of the regression coefficients.

Normality of Residuals

The normality assumption was examined using the Kolmogorov–Smirnov test. The results are presented in Table 7.

Table 7 Normality test of residuals (Kolmogorov–Smirnov)

Statistic	Value
N	60
Test Statistic	0.066
Asymp. Sig. (2-tailed)	0.200

The significance value ($p = 0.200$) exceeds the 0.05 threshold, indicating that the residuals are normally distributed. Therefore, the normality assumption was satisfied, and no data transformation was required.

Multicollinearity

Multicollinearity was assessed to ensure that the independent variables were not excessively correlated. The results are shown in Table 8.

Table 8 Multicollinearity test results

Variable	Tolerance	VIF
Emotional Intelligence (EI)	0.807	1.239
Spiritual Intelligence (SI)	0.807	1.239

All tolerance values exceed 0.10, and all Variance Inflation Factor (VIF) values are well below the critical value of 10. These findings indicate the absence of multicollinearity. Emotional intelligence and spiritual intelligence can therefore be included simultaneously in the regression model.

Heteroscedasticity

The Glejser test was employed to examine homoscedasticity. The results are presented in Table 9.

Table 9 Heteroscedasticity test results (Glejser method)

Variable	Sig.
Emotional Intelligence (EI)	0.487
Spiritual Intelligence (SI)	0.444

Because the significance values for both predictors exceed 0.05, no heteroscedasticity was detected. Taken together, the assumptions of normality, absence of multicollinearity, and homoscedasticity were satisfied. The regression model was therefore deemed statistically appropriate for hypothesis testing.

Multiple Linear Regression Analysis

After confirming the adequacy of the assumptions, multiple linear regression analysis was conducted to determine the predictive contribution of emotional intelligence and spiritual intelligence to students' physics learning outcomes.

Model Summary

The overall model fit is presented in Table 10.

Table 10 Model summary

R	R^2	Adjusted R^2	Std. Error
0.557	0.310	0.286	346.289

The coefficient of determination ($R^2 = 0.310$) indicates that 31% of the variance in physics learning outcomes can be explained jointly by emotional intelligence and spiritual intelligence. The adjusted R^2 value (0.286) confirms that the model retains adequate explanatory power after accounting for the number of predictors. These findings suggest that non-cognitive factors contribute meaningfully to students' academic performance in physics.

Simultaneous Effect (F-test)

The overall significance of the regression model was tested using the F-test. The results are presented in Table 11.

Table 11 F-test results

F	Sig.
12.831	0.000

Because $p < 0.05$, the regression model is statistically significant. Thus, emotional intelligence and spiritual intelligence simultaneously exert a significant influence on physics learning outcomes.

Partial Effects (t-test)

To examine the individual contribution of each predictor, partial significance tests were conducted. The results are shown in Table 12.

Table 12 T-test results

Variable	B	Beta	t	Sig.
Emotional Intelligence (EI)	0.208	0.390	3.183	0.002
Spiritual Intelligence (SI)	0.127	0.262	2.144	0.036

Both emotional intelligence (β = 0.390, p = 0.002) and spiritual intelligence (β = 0.262, p = 0.036) demonstrate statistically significant positive effects on physics learning outcomes. The positive regression coefficients indicate that increases in either variable are associated with improvements in academic performance. Notably, the standardized beta coefficient reveals that emotional intelligence contributes more strongly than spiritual intelligence within the regression model. Based on these results, the regression equation can be expressed as:

$$Y = 69.764 + 0.208(EI) + 0.127(SI)$$

This equation suggests that each one-unit increase in emotional intelligence or spiritual intelligence is associated with a corresponding increase in physics learning outcomes, with emotional intelligence showing a comparatively stronger predictive influence.

The findings of this study indicate that emotional intelligence exerts a significant influence on students' physics learning outcomes. Theoretically, this result aligns with Goleman's (1995) conceptualization of emotional intelligence, which emphasizes the capacity to recognize, understand, and regulate emotions as a foundation for individual success. In the context of physics learning, emotional regulation is particularly critical, as students are frequently confronted with abstract concepts, mathematical reasoning processes, and evaluative situations that may trigger academic anxiety. Students with well-developed emotional intelligence are more likely to manage pressure effectively, sustain intrinsic motivation, and demonstrate persistence when engaging with complex physics problems.

These findings are consistent with the meta-analytical evidence reported by Sánchez-Álvarez et al., (2020) and Quílez-Robres et al., (2023), which highlights a positive association between emotional intelligence and academic achievement across educational levels. Within science education, Shengyao et al., (2024) further argue that emotional intelligence contributes to academic success through the mediation of positive psychological traits such as resilience and academic optimism. More specifically in physics, (Daodu & Ojedapo, 2021) identified self-awareness and emotional regulation as significant predictors of secondary students' physics achievement. In the Indonesian context, Widyawati et al. (2024) and Rivani et al. (2022) similarly reported that emotional intelligence enhances both the quality of physics learning processes and students' learning motivation.

The standardized beta coefficient obtained in this study indicates that emotional intelligence contributes more substantially than spiritual intelligence to physics learning outcomes. This suggests that emotional regulation, self-motivation, empathy, and social competence have a more immediate and direct relationship with day-to-day academic performance. Such a finding resonates with Amponsah et al., (2024), who emphasize that emotional intelligence strengthens self-efficacy and academic engagement in science learning. At the national level, Aljura et al., (2024), through a meta-analysis in mathematics education, also found that emotional intelligence significantly predicts learning outcomes, particularly through the dimension of self-regulation.

In addition to emotional intelligence, spiritual intelligence was also found to have a significant positive effect on physics learning outcomes. Conceptually, King & DeCicco (2009) define spiritual intelligence as the capacity to construct meaning, develop existential awareness, and orient one's actions according to deeply held values. In educational settings, this dimension supports psychological resilience, sustained commitment, and consistency in facing academic challenges. A recent meta-analysis by Zhou et al., (2024) confirms a positive relationship between spiritual intelligence and academic achievement, although the magnitude of its effect tends to be more moderate compared to emotional intelligence.

Within the Indonesian educational context, the present findings are consistent with studies conducted by Maulana (2022); Suwardi et al., (2021), which demonstrate that the integration of emotional and spiritual intelligence correlates positively with students' academic achievement. Imamuddin et al. (2023) further report that spiritual intelligence enhances perseverance and meaning-oriented learning in mathematics. Although empirical research on spiritual intelligence in physics remains limited, prior findings suggest that non-cognitive dimensions contribute meaningfully to students' academic performance in science-related disciplines.

When examined simultaneously, emotional intelligence and spiritual intelligence jointly explain a meaningful proportion of variance in physics learning outcomes. This reinforces the view that success in physics is not determined solely by cognitive ability but is also shaped by students' emotional readiness and value orientation. Rosadi (2023) argues that the integration of emotional and spiritual dimensions fosters a positive school culture, which in turn supports academic achievement. Similarly, Ajadi & Amoo (2024) contend that psychological factors—including emotional regulation, motivation, and value orientation—serve as critical determinants of physics learning success.

From a conceptual standpoint, emotional intelligence and spiritual intelligence can be understood as complementary dimensions. Emotional intelligence primarily governs students' immediate responses to learning demands, such as managing examination anxiety or maintaining motivation when encountering challenging tasks. Spiritual intelligence, in contrast, provides a deeper framework of meaning and purpose, ensuring that learning is not merely grade-oriented but also directed toward personal growth and self-development. The synergy between these two dimensions contributes to more stable and sustainable academic resilience.

From a practical perspective, these findings suggest that physics instruction may benefit from integrating strategies that promote emotional regulation, reflective value engagement, and intrinsic motivation. Such integration is not intended to diminish the emphasis on conceptual mastery or higher-order thinking skills. Rather, it enriches the learning experience by addressing the holistic development of students. Through a more comprehensive approach, physics education has the potential not only to enhance academic achievement but also to cultivate character development and psychological resilience among learners.

CONCLUSION

The findings of this study demonstrate that both emotional intelligence and spiritual intelligence significantly influence students' physics learning outcomes, both partially and simultaneously. The regression model accounted for 31% of the variance in physics achievement ($R^2 = 0.310$), indicating a meaningful contribution of non-cognitive factors to academic performance. At the individual level, emotional intelligence showed a stronger predictive contribution ($\beta = 0.390$) than spiritual intelligence ($\beta = 0.262$), although both variables were statistically significant. This study employed a correlational design with a sample drawn from a single school, which limits the generalizability of the findings. Nevertheless, the results underscore the importance of extending physics instruction beyond a sole emphasis on cognitive competence. Pedagogical strategies that foster emotional regulation, empathy development, and the strengthening of students' spiritual dimensions may enhance not only academic achievement but also students' psychological resilience and character formation. Accordingly, physics education should be envisioned as a holistic endeavor—one that integrates intellectual rigor with emotional maturity and meaningful value orientation—so that students are better prepared to navigate academic challenges with persistence, clarity of purpose, and adaptive resilience.

CONFLICTS OF INTEREST

No conflict of interest was reported by the authors in the context of this publication.

AUTHOR CONTRIBUTIONS STATEMENT

Each of the three authors played a vital and complementary role throughout the process, from the initial planning stage to the publication of this research. EF was responsible for data collection and drafting the preliminary version of the manuscript. AS contributed by selecting the research instruments, ensuring their methodological validity, and refining the structure and language of the article. Meanwhile, SM validated the instruments, examined the outcomes of the field implementation, and assisted in refining the final draft of the paper. All contributing authors thoroughly reviewed and endorsed the completed manuscript before it was submitted for publication

AI DISCLOSURE STATEMENT

The author used ChatGPT during the manuscript preparation process solely for translation and language refinement. After using these tools, the author carefully reviewed and revised the entire manuscript and assumes full responsibility for the content and accuracy of the work. All aspects of the research design, data collection, data analysis, and conclusion drawing were conducted entirely by the author without the assistance of artificial intelligence (AI).

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