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Examining the Interaction Between Behavioral and Emotional Engagement on Cognitive Engagement: A Mediation Analysis

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ABSTRACT

This study investigates how behavioral and emotional engagement relate to cognitive engagement among elementary school students using a quantitative survey design and structural modeling. Data were collected from 240 Grade 4-6 students recruited through convenience sampling using a 15-item, four-point Likert questionnaire. Confirmatory Factor Analysis (SmartPLS 4) was used to evaluate construct validity and reliability, while Structural Equation Modeling tested the hypothesized relationships among engagement dimensions. The measurement model supported a three-factor structure after removing five low-loading items, with the retained indicators demonstrating adequate convergent and discriminant validity. The structural model showed acceptable fit (SRMR = 0.042; NFI = 0.919). Behavioral engagement positively predicted emotional engagement ($\beta = 0.304$, $p < 0.001$) and cognitive engagement ($\beta = 0.152$, $p = 0.036$). Emotional engagement also positively predicted cognitive engagement ($\beta = 0.137$, $p = 0.040$). The indirect effect of behavioral engagement on cognitive engagement through emotional engagement was not significant ($\beta = 0.042$, $p = 0.073$), although the total effect remained significant ($\beta = 0.194$, $p = 0.004$). Explained variance was modest ($R^2 = 0.092$ for emotional engagement; $R^2 = 0.055$ for cognitive engagement), and effect sizes were small ($f^2 = 0.018$-0.102). These results suggest that strengthening students' active participation and supporting positive learning emotions may contribute to cognitive effort, while additional classroom and contextual factors should be considered in elementary school settings.

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1. INTRODUCTION

Student engagement in the learning process involves the energy and effort students invest in their learning communities and can be observed through behavioral, cognitive, and affective dimensions (Bond et al., 2020). Engagement influences how actively and meaningfully students participate in learning and is closely related to motivation and academic achievement. Student engagement is also considered a key factor in addressing low academic performance, boredom and disengagement, and high dropout rates (Bekker et al., 2023; Szabó et al., 2024). Learning experiences that promote active participation and authentic engagement are therefore essential in classroom practice (Salas-Pilco et al., 2022).

Student engagement remains a significant challenge in many classrooms. A lack of engagement can reduce learning motivation, increase boredom, and raise dropout risk (Junianto et al., 2021; Pradhata & Muhid, 2021). Student engagement is critical for achieving learning competencies and overall school success and is reflected through behavioral, emotional, and cognitive dimensions (Jamain et al., 2024). Student engagement is commonly described through three interrelated dimensions. Behavioral engagement refers to students' active involvement

in learning through persistence and task completion, indicating commitment to learning activities (Mamun & Lawrie, 2023).

Observable indicators commonly include effort, attention, and participation in classroom or school events (Gomes et al., 2023; Monteiro et al., 2021). Emotional engagement is shaped by interactions with teachers and peers as well as students' internal emotional states, including mood and perceived treatment (Susanti et al., 2020). Emotional engagement also reflects students' positive and negative emotional reactions toward learning and social relationships in school settings (Wester et al., 2021). Cognitive engagement refers to students' mental effort to understand material, solve problems, and maintain focus during learning (Khan et al., 2023), and it involves concentration and intellectual effort in processing and applying knowledge (Huang et al., 2022; Weich et al., 2024).

Accurate measurement of student engagement remains challenging, particularly at the elementary school level where engagement plays a critical role in shaping long-term learning habits. Without appropriate measurement tools, teachers may struggle to assess whether students are genuinely and meaningfully engaged in the learning process (Hasanov et al., 2021). This challenge matters because engagement is positively linked to academic achievement and psychological well-being and supports an effective learning climate (Perry, 2022).

Several studies have developed and tested instruments for measuring student engagement; however, many focus on higher education or online learning contexts. A web-based engagement instrument has been validated for online learning (Sharif-Nia et al., 2023). Other work has emphasized the importance of contextualizing measurement tools based on learner characteristics and learning environments (Tomás et al., 2022). These trends indicate the need for an elementary-level engagement instrument that is psychometrically sound and supports analysis of interrelationships among engagement dimensions.

This study addresses the gap by developing and testing construct validity and reliability using Confirmatory Factor Analysis (CFA) and by analyzing the structural relationships among behavioral, emotional, and cognitive engagement using Structural Equation Modeling (SEM). Behavioral participation may foster interest and enthusiasm and support readiness for deeper cognitive effort (Alonso-Tapia et al., 2023; Bergdahl et al., 2024). Active behavior may also serve as a foundation for students' engagement in intellectual tasks (English, 2024; Tshering et al., 2024). Emotional engagement has been associated with more active cognitive involvement and learning outcomes (Vidić, 2024; Reeve et al., 2025). Positive emotions such as enthusiasm and joy are associated with cognitive effort and improved learning outcomes, supporting the examination of emotional engagement as a mediator (Dubovi, 2022). The hypotheses are as follows:

H1: Behavioral engagement has a positive and significant effect on emotional engagement among elementary school students.

H2: Behavioral engagement has a positive and significant effect on cognitive engagement among elementary school students.

H3: Emotional engagement has a positive and significant effect on cognitive engagement among elementary school students.

H4: Emotional engagement mediates the effect of behavioral engagement on cognitive engagement among elementary school students.

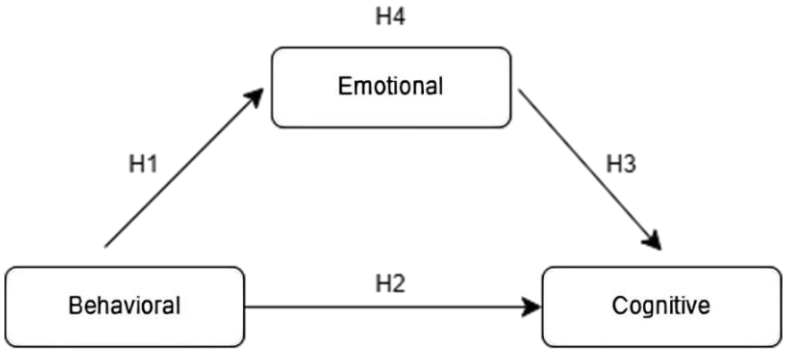

Figure 1. Conceptual Model of Student Engagement.

2. METHOD

2.1 Sample

This study employed a quantitative survey design to examine the construct validity of an elementary school student engagement instrument and to analyze structural relationships among engagement dimensions.

Survey research collects information from a sample using a structured instrument to describe patterns and examine relationships that can inform understanding beyond the sampled group (Gul, 2023). The approach is suitable in educational settings because it can capture students' perceptions of their learning experiences at scale.

Convenience sampling was used, with elementary schools selected based on accessibility and availability to the research team rather than random selection (Andrade, 2021). All students in Grades IV, V, and VI within the participating schools were included. The final sample comprised 240 students: Grade IV (34.2%), Grade V (38.8%), and Grade VI (27.0%). Evidence from survey research comparing convenience and randomized recruitment highlights that convenience-based participation can constrain representativeness and may affect the validity and generalizability of survey-based evidence (Silveira et al., 2023). Replication using probability-based sampling or broader multi-site coverage is recommended to strengthen external validity.

2.2 Instrument

Data were collected using a questionnaire based on a student engagement instrument developed from several previous studies (Sharif-Nia et al., 2023; Tomás et al., 2022; Wong & Liem, 2022; Xu et al., 2024), which classify student engagement into three main dimensions: behavioral, cognitive, and emotional. The instrument consisted of 15 statements measured on a 4-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (4).

Table 1. Dimension and Statements of the Instrument

Dimension	Statements
Behavioral	1. I study because I want to.
	2. I manage my own time for studying.
	3. I read the textbooks provided by the teacher.
	4. I read the notes or modules that I am required to study.
	5. I use a computer, tablet, or phone for learning.
	6. I complete school assignments using technology.
	7. I search for additional information on the internet when I do not understand.
	8. I ask others or look in books when I do not understand.
Cognitive	9. I enjoy reading books outside of school subjects.
	10. I read stories or informational books that I choose myself.
	11. I reflect on what I have learned.
	12. I try to connect what I learn with everyday life.
Emotional	13. When the teacher explains new material, I feel enthusiastic and interested in paying attention.
	14. I am interested in the material taught by the teacher.
	15. I feel enthusiastic about participating in class lessons.

2.3 Data Analysis

The data were analyzed using Confirmatory Factor Analysis (CFA) with SmartPLS 4 software. CFA was conducted to assess the fit between the empirical data and the theoretical model of the three student engagement dimensions. CFA was chosen because it allows for the evaluation of factor structures based on existing theories (Kline, 2023). The model evaluation criteria included: (1) standardized factor loading ≥ 0.70, indicating a significant contribution of each item to its respective construct (Hair et al., 2019); (2) convergent validity and construct reliability assessed through Average Variance Extracted (AVE ≥ 0.50), Composite Reliability (CR ≥ 0.70), and Cronbach's Alpha (≥ 0.70) (Hair et al., 2019); (3) discriminant validity tested using the Heterotrait-Monotrait Ratio (HTMT < 0.85) and the Fornell-Larcker criterion, where the square root of the AVE for each construct must be greater than its correlations with other constructs (Henseler et al., 2015); and (4) model fit indices, including RMSEA $\leq 0{,}06$, SRMR $\leq 0{,}08$, CFI, NFI, dan TLI $\geq 0{,}95$, and $\chi^2/df \leq 3$ (Hu & Bentler, 1999; Kline, 2023). The analysis was conducted in stages, beginning with the outer model evaluation and continuing with the assessment of validity, reliability, and overall model fit.

After construct validity was confirmed through the measurement model analysis, Structural Equation Modeling (SEM) was performed using SmartPLS to test the relationships among the engagement dimensions. Significance was determined based on a t-statistic value (> 1,96 pada taraf signifikansi 5%), while path coefficients were used to interpret the direction and strength of the relationships between constructs (Hair et al., 2021). The R^2 value was used to evaluate the proportion of variance in the dependent construct explained by the independent constructs. The f^2 and Q^2 values were used to assess the effect size and predictive relevance of the constructs in the structural model. According to Hair et al. (2017), values of 0.02, 0.15, and 0.35 represent small,

medium, and large effect sizes, respectively. Multicollinearity was tested using the Variance Inflation Factor (VIF), with values ≤ 5 indicating no problematic correlations among indicators that could distort model estimates (Hair et al., 2011). Model goodness-of-fit was evaluated using the Standardized Root Mean Square Residual (SRMR) and Normed Fit Index (NFI). According to Hu & Bentler. (1999) the model is considered a good fit if SRMR ≤ 0,08 dan NFI ≥ 0,95.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1. Confirmatory Factor Analysis (CFA)

CFA was conducted to examine the construct validity of student engagement, which consists of three dimensions: behavioral, cognitive, and emotional.

Table 2. Factor Loadings, Reliability, and Validity of Student Engagement Dimensions

Dimension	Code	Statements	Loading	α	CR	AVE
Behavioral	B1	I study because I want to.	.061	.944	.948	.811
	B2	I manage my own time for studying.	.094			
	B3	I read the textbooks provided by the teacher.	**.916**			
	B4	I read the notes or modules that I am required to study.	**.965**			
	B5	I use a computer, tablet, or phone for learning.	**.864**			
	B6	I complete school assignments using technology.	.023			
	B7	I search for additional information on the internet when I do not understand.	**.852**			
	B8	I ask others or look in books when I do not understand.	.144			
Cognitive	C1	I enjoy reading books outside of school subjects.	**.859**	.920	.929	.798
	C2	I read stories or informational books that I choose myself.	**.843**			
	C3	I reflect on what I have learned.	.006			
	C4	I try to connect what I learn with everyday life.	**.971**			
Emotional	E1	When the teacher explains new material, I feel enthusiastic and interested in paying attention.	**.798**	.897	.900	.757
	E2	I am interested in the material taught by the teacher.	**.977**			
	E3	I feel enthusiastic about participating in class lessons.	**.826**			

In the initial stage, several indicators showed factor loadings below 0.70 and were thus eliminated from the model to improve model fit. After removal, the remaining indicators exhibited loading values ranging from 0.798 to 0.977, indicating strong contributions to their respective constructs. The Cronbach's Alpha and Composite Reliability (CR) values for all constructs were above 0.70, demonstrating excellent internal consistency. The Average Variance Extracted (AVE) values also exceeded 0.50, indicating that the constructs met the criteria for convergent validity (Table 2). Discriminant validity was tested using two approaches: the Heterotrait-Monotrait Ratio (HTMT) and the Fornell-Larcker Criterion. The results are presented in Table 3.

Table 3. Discriminant Validity: HTMT and Fornell-Larcker Criteria

Dimension	HTMT			Fornell Larcker		
	Behavioral	Cognitive	Emotional	Behavioral	Cognitive	Emotional
Behavioral	-	.208	.325	**.901**	.172	.277
Cognitive	.208	-	.198	.172	**.893**	.173
Emotional	.325	.198	-	.277	.173	**.870**

Discriminant validity was confirmed using two approaches. First, the square root of the AVE for each construct was greater than its correlations with other constructs (Fornell-Larcker criterion). Second, the Heterotrait-Monotrait Ratio (HTMT) values for all construct pairs were below 0.85, further supporting the conceptual distinctiveness among the student engagement dimensions. The measurement model's adequacy was assessed using several goodness-of-fit indices. The results indicated that all fit indices met the recommended thresholds, suggesting a satisfactory model fit (Table 4).

Table 4. Goodness-of-Fit Indices for the CFA Model

Fit Indices	Value	Cut-off Criteria	Interpretation
Chi-square (x^2)	38.392	-	Good fit
Degrees of Freedom (df)	32.00	-	-
p-value	.202	>0.05	Not significant (Good)
x^2 / df	1.20	< 2.00	Good fit
CFI	.997	≥ 0.95	Good fit
TLI	.996	≥ 0.95	Good fit
NFI	.981	≥ 0.95	Good fit
RMSEA	.029	≤ 0.06	Good fit
SRMR	.037	≤ 0.08	Good fit

Figure 2 presents the final Confirmatory Factor Analysis (CFA) model, which illustrates student engagement across three main dimensions: behavioral, cognitive, and emotional.

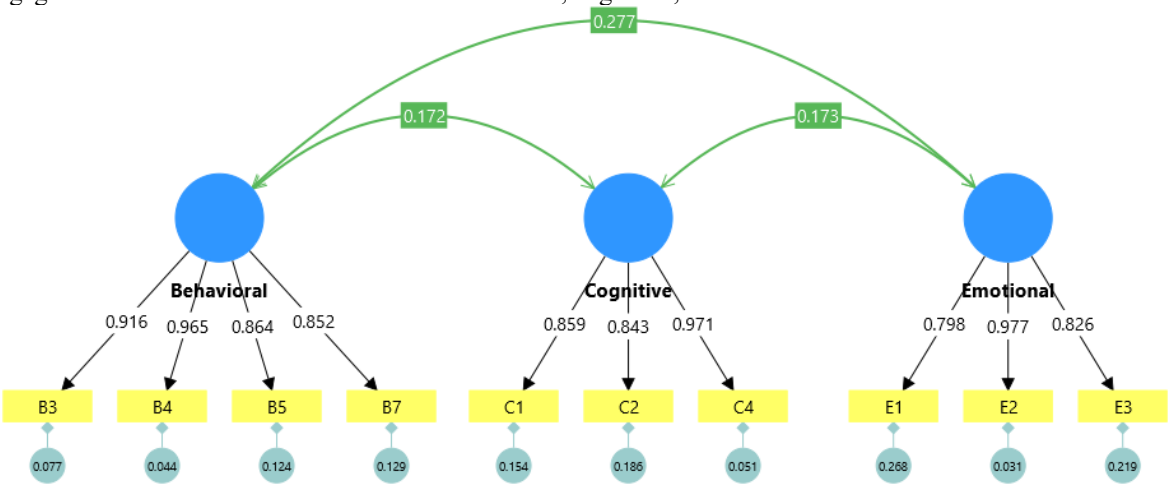

Figure 2. Confirmatory Factor Analysis (CFA) Model of Student Engagement

Each construct consisted of indicators with high factor loadings, ranging from 0.798 to 0.977, indicating a strong contribution to their respective latent variables. The correlations between constructs were relatively low but statistically significant, supporting the discriminant validity of each engagement dimension. The highest correlation was observed between behavioral and emotional engagement (0.277), followed by emotional and cognitive engagement (0.173), and behavioral and cognitive engagement (0.172). These findings indicate that although the dimensions are interrelated, they possess distinct structural characteristics.

3.1.2. Structural Model Analysis

Structural model analysis was conducted to examine the effects among the dimensions of student engagement.

Table 5. Path Coefficients and Significance Levels in the Structural Model

Hubungan	β (Original Sample)	Standar Error	t-statistic	p-value
Behavioral→Emotional	0.304	0.058	5.198	0.000

Behavioral→Cognitive	0.152	0.073	2.093	0.036
Emotional→Cognitive	0.137	0.067	2.053	0.040

The analysis results indicated that behavioral engagement had a positive and significant effect on emotional engagement ($\beta = 0.304$, $t = 5.198$, $p < 0.001$), as well as on cognitive engagement ($\beta = 0.152$, $t = 2.093$, $p = 0.036$). In addition, emotional engagement also had a positive and significant effect on cognitive engagement ($\beta = 0.137$, $t = 2.053$, $p = 0.040$). All relationships among the variables in the model showed significance levels below 0.05, indicating that the associations were statistically significant and unlikely to have occurred by chance. Following the confirmation of statistically significant relationships among all student engagement dimensions, the structural model is illustrated in Figure 2.

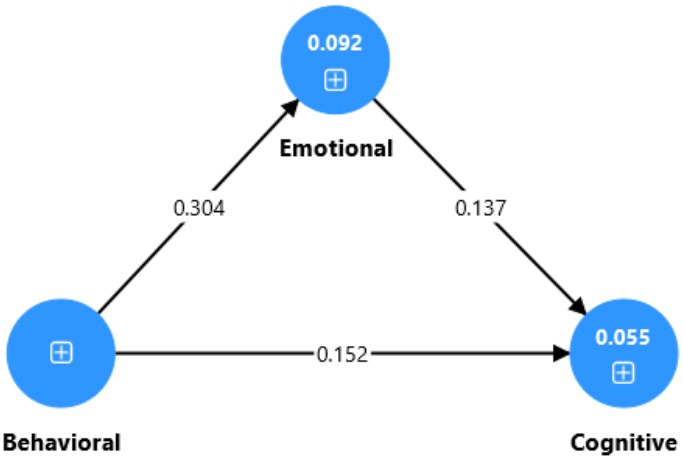

Figure 3. Structural Model of Student Engagement

The structural model illustrated in Figure 3 displays the direction and strength of the relationships among the engagement dimensions, including the R^2 values of the endogenous constructs. The figure highlights the role of behavioral engagement as a key predictor of both emotional and cognitive engagement, as well as the mediating role of emotional engagement in influencing cognitive engagement.

In addition to the direct effects, the analysis also included indirect and total effects to examine the mediating role of emotional engagement in the relationship between behavioral and cognitive engagement, as presented in Table 6.

Table 6. Indirect and Total Effects Between Engagement Dimensions

Construct Relationship	Indirect Effect (β)	t-statistic	p-value	Total Effect (β)	t-statistic	p-value
Behavioral→Emotional	-	-	-	0.304	5.198	0.000
Behavioral→Cognitive	0.042	1.796	0.073	0.194	2.847	0.004
Emotional→Cognitive	-	-	-	0.137	2.053	0.040

The results of the indirect and total effects are presented in Table 6. The mediating role of emotional engagement in the relationship between behavioral engagement and cognitive engagement was not statistically significant ($p = 0.073$). However, the total effect of behavioral engagement on cognitive engagement was statistically significant ($p = 0.004$). Other direct paths also demonstrated significant effects ($p < 0.05$).

Table 7. Result of Coefficient of Determination (R^2), Predictive Relevance (Q^2), Variance Inflation Factor (VIF), and Effect Size (f^2)

Dimension	R^2	Q^2	Construct Relationship	VIF	f^2
Behavioral	-	-	Behavioral→Cognitive	1.102	.022
Cognitive	.055	.027	Behavioral→Emotional	1.000	.102
Emotional	.092	.084	Emotional→Cognitive	1.102	.018

The coefficient of determination (R^2) indicated that 9.2% of the variance in emotional engagement was explained by behavioral engagement, while 5.5% of the variance in cognitive engagement was explained by both behavioral and emotional engagement. The effect sizes (f^2) for each path were categorized as small, although the

effect of behavioral engagement on emotional engagement approached the threshold for a medium effect. All Q^2 values were positive, indicating that the model had predictive relevance, although still relatively weak. Meanwhile, the behavioral engagement construct did not have R^2 or Q^2 values, as it served as an exogenous construct that was not predicted by any other construct in the model. Additionally, the multicollinearity test showed that all Variance Inflation Factor (VIF) values were below the threshold of 3.3, indicating no multicollinearity issues among constructs in the structural model.

To evaluate the overall model fit, several goodness-of-fit (GoF) indices were used in the SEM analysis. The results showed an SRMR value of 0.042, which was below the maximum threshold of 0.08, indicating a low level of approximation error and a good fit between the model and the data. The NFI value of 0.919 also reflected an acceptable model fit, as it exceeded the minimum standard of 0.90. Overall, these model fit results support the structural validity of the student engagement model tested in this study.

3.2 Discussion

The measurement model supported student engagement as a three-dimensional construct comprising behavioral, emotional, and cognitive engagement. These dimensions were distinguishable and could be measured appropriately in the present sample. The structural analysis indicated that behavioral engagement was positively associated with emotional engagement and cognitive engagement, and emotional engagement was also positively associated with cognitive engagement. The observed relationships were small in magnitude, and the model explained only a limited portion of variance in emotional and cognitive engagement. The mediation test showed that emotional engagement did not function as a significant intermediary between behavioral and cognitive engagement. These results clarify the pattern of relationships among engagement dimensions in an elementary school context.

3.2.1 Construct Validity of Student Engagement

The analysis results indicate that the construct of student engagement in elementary education comprises three main dimensions: behavioral, emotional, and cognitive engagement, which were well validated through Confirmatory Factor Analysis (CFA). Most indicators demonstrated high loading values, and each dimension met the criteria for reliability and convergent validity. In addition, discriminant validity was confirmed, and the model was found to be statistically acceptable based on goodness of fit indices within the recommended thresholds. These findings align with recent syntheses that conceptualize student engagement as a multidimensional construct with related yet distinct behavioral, emotional/affective, and cognitive components, supporting its use in subsequent analyses of relationships among variables (Bergdahl et al., 2024).

However, not all indicators in the model met the validity criteria. Several items with low loading values, such as "I learn because I want to" and "I complete school assignments using technology", were excluded from the model, although they are conceptually relevant to cognitive and behavioral engagement. In contrast, two other technology-related items, "I use a computer, tablet, or phone for learning." and "I search for additional information on the internet when I do not understand.", showed high loadings and were retained. This variation suggests the need for further analysis regarding the context and students' experiences in using technology for learning.

This may be influenced by barriers to technology integration in education, which can stem from limitations in infrastructure, training, and administrative support, as well as from instructional approaches that fail to encourage student autonomy and active participation in learning (David & Weinstein, 2024; Tawfik et al., 2021). A study by Pino & Mongas. (2025) showed that the success of technology integration in education is highly dependent on content readiness, teacher support, and adequate infrastructure. Consistent with this, Consoli et al. (2024) emphasized the importance of the quality of technology integration, particularly in terms of cognitive activation and meaningful instructional support. These findings indicate that the failure of certain indicators may reflect the suboptimal implementation of technology in elementary schools, both in terms of systemic readiness and students' active engagement in digital learning processes.

3.2.2 Behavioral Engagement and Emotional Engagement

The analysis revealed that behavioral engagement had a positive and significant effect on emotional engagement among elementary school students. Active learning behaviors, such as reading materials, using technology, and seeking additional information, were correlated with increased student interest and enthusiasm in the learning process. Although the effect size was small and the model's explanatory power and predictive relevance were low, the relationship remained statistically meaningful. This indicates that behavioral engagement accounts for only a small portion of the variance in emotional engagement, yet still provides a meaningful positive contribution.

These findings are consistent with previous research showing a positive and significant correlation between behavioral and emotional engagement (Alonso-Tapia et al., 2023) particularly in the context of practical

and participatory learning activities. In their systematic review. Bergdahl et al. (2024) emphasized that student engagement consists of multiple interacting dimensions, and that emotional expressions during learning often emerge as a response to active participation and interest, both of which are indicators of behavioral engagement. Although the strength of the relationship was modest, its direction aligns with theoretical and empirical evidence. The limited effect size may be related to characteristics specific to elementary students, the structured nature of classroom instruction, or other unaccounted variables such as the quality of social relationships, students' perceptions of their teachers, or supportive learning environments (Thornberg et al., 2022).

3.2.3 Behavioral and Cognitive Engagement

The analysis showed that behavioral engagement had a positive and significant effect on cognitive engagement among elementary school students, although the effect size was small. Active learning behaviors, such as reading materials, using technology, and seeking additional information, form the basis for cognitive engagement, which involves efforts to understand concepts in depth and to relate lessons to everyday life. This finding is consistent with the concept proposed by English. (2024), who explained that attendance, active participation, and student compliance in learning activities establish a critical foundation for cognitive engagement. Similar empirical findings were reported by Tshering, Dorji and Jatsho. (2024), who found that increasing behavioral engagement through active learning strategies significantly enhances cognitive engagement, particularly in terms of students' readiness to take on intellectually demanding tasks.

Although the relationship was statistically significant, the effect size was relatively small, and the model explained only a limited portion of the variance in cognitive engagement, with predictive relevance also remaining low. This suggests that although active learning behavior contributes meaningfully, cognitive engagement among elementary students is likely influenced by other, more dominant factors such as learning strategies, intrinsic motivation, or teacher support, which were not captured in the current model (Vestad & Bru, 2023). The complexity of cognitive processes, which involve reflection, meaning making, and conceptual integration, requires a more comprehensive instructional approach rather than relying solely on behavioral engagement.

3.2.4 Emotional and Cognitive Engagement

The analysis revealed a positive relationship between emotional engagement and cognitive engagement among elementary school students. Emotional engagement, as reflected in enthusiasm and interest toward learning materials, contributed to increased cognitive involvement, particularly in terms of attention, learning readiness, and mental participation during the learning process. This finding is consistent with the study by Vidić. (2024), which demonstrated a positive association between emotional and cognitive engagement among elementary students. In addition, Reeve et al. (2025) in their meta-analysis, found that emotional engagement strongly contributes to learning outcomes driven by motivation and psychological needs, which are fundamental to cognitive engagement.

Although the effect size was small, the model's explanatory power and predictive relevance were also relatively low. This suggests that emotional engagement alone may not be sufficient to optimally enhance cognitive engagement, as cognitive involvement is more strongly influenced by students' learning strategies and metacognitive abilities in planning, monitoring, and regulating their learning processes (An et al., 2024; Zepeda & Nokes-Malach, 2021). Cognitive engagement is likely shaped by a combination of factors such as learning strategies, academic support from teachers, and students' reflective capacities, which are developed through high quality instructional interactions and autonomy support (de Ruig et al., 2023; Zhao & Qin, 2021). Therefore, strategies that promote social interaction, emotional comfort, and meaningful learning experiences are essential, as students tend to be more engaged when they feel supported and are able to construct meaning collaboratively (Kaspar & Massey, 2022; Sun et al., 2020).

3.2.5 The Mediating Role of Emotional Engagement

The mediation analysis indicated that emotional engagement did not significantly mediate the effect of behavioral engagement on cognitive engagement among elementary school students. Behavioral engagement and emotional engagement both contributed directly to cognitive engagement, but the indirect pathway via emotional engagement was not strong enough to support a meaningful mediating effect. This pattern does not fully align with literature that emphasizes emotional engagement as an important mechanism supporting deeper learning processes. Evidence suggests that positive emotions such as joy and enthusiasm are associated with greater cognitive effort, which can support cognitive engagement during learning (Dubovi, 2022).

Nevertheless, some studies have also shown that emotional engagement does not always mediate the relationship between behavioral and cognitive engagement, but rather operates indirectly through learning strategies. Tannoubi et al. (2025) reported that emotional engagement tends to influence learning outcomes indirectly through learning approaches, rather than serving as a mediator between the two other engagement types.

Likewise, Tshering et al. (2024) noted that behavioral and cognitive engagement can increase simultaneously in response to active learning interventions without emotional engagement playing a mediating role.

These differences can be understood in the context of elementary students' developmental characteristics, as they are still developing emotionally and often require external support for emotion regulation. In addition, learning strategies that directly target behavioral engagement and cognitive processing have been found to be more effective in enhancing cognitive engagement than affective pathways (Cunha et al., 2023; Thümmler et al., 2022). This finding reinforces the idea that in the context of elementary education, strengthening cognitive engagement is more effectively achieved through direct activation of behavioral engagement, without relying on emotional engagement as the primary mediator.

4. CONCLUSION

This study aimed to examine the relationships among three dimensions of student engagement in elementary education: behavioral, emotional, and cognitive engagement. The analysis revealed that all dimensions were positively and significantly related. Behavioral engagement was found to influence both emotional and cognitive engagement, while emotional engagement also contributed to cognitive engagement. However, emotional engagement did not significantly mediate the relationship between behavioral and cognitive engagement. These findings suggest that behavioral engagement plays a more direct and influential role in promoting cognitive engagement. Although the effect sizes were small and the model's ability to explain cognitive engagement was limited, the results emphasize the importance of fostering active learning behavior as a foundation for deeper engagement. Instructional strategies in elementary schools should focus on enhancing independent learning activities, the use of technology, and the creation of meaningful learning experiences. Future research may explore additional factors such as motivation, teacher support, or learning strategies to develop a more comprehensive model of student engagement.

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