Correlation of Student Engagement in Bluebonnet Learning and Academic Performance in Middle School Mathematics

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DOI: https://dx.doi.org/10.47772/IJRISS.2026.10100304

Received: 17 January 2026; Accepted: 22 January 2026; Published: 04 February 2026

ABSTRACT

Student engagement is a key factor influencing academic performance, particularly in middle school mathematics, where motivation and active participation are often challenging. This study examined the relationship between eighth-grade students' engagement with Bluebonnet Learning mathematics materials and their academic performance. Using a correlational design, 56 eighth-grade students participated through universal sampling during the first semester of the 2025–2026 academic year. Engagement was measured using the validated Student Engagement with Bluebonnet Learning (SEBL) instrument ($\alpha = 0.87$), and mathematics performance was assessed via a teacher-made midterm examination aligned with the Texas Essential Knowledge and Skills (TEKS; $\alpha = 0.85$). Descriptive analyses indicated moderate to high engagement across behavioral, cognitive, and emotional domains, with cognitive engagement scoring highest ($M = 3.27$, $SD = 0.48$). Pearson correlations showed positive relationships between all engagement domains and mathematics performance, with cognitive engagement exhibiting the strongest correlation ($r = .56$, $p < .01$). Multiple regression analysis revealed that cognitive engagement was the only statistically significant unique predictor of mathematics performance ($\beta = .41$, $t = 3.28$, $p = .002$), accounting for the largest proportion of variance ($R^2 = .36$, adjusted $R^2 = .32$). These findings suggest that deeper cognitive involvement with structured, standards-aligned materials supports higher academic achievement, highlighting the importance of instructional strategies that promote behavioral, cognitive, and emotional engagement in middle school mathematics classrooms.

Keywords: student engagement, Bluebonnet Learning, mathematics performance, middle school, cognitive engagement

INTRODUCTION

Mathematics achievement and student engagement remain central challenges in middle school education, as many students struggle to maintain motivation and active participation in mathematics classrooms. Engagement, defined as the behavioral, cognitive, and emotional involvement of learners in learning activities, is a strong predictor of academic success in mathematics (Fredricks, Blumenfeld, & Paris, 2004; Appleton, Christenson, Kim, & Reschly, 2006). In recent years, educators and policymakers have turned to structured, standards-aligned instructional materials to support teachers and increase student engagement. In Texas, the Texas Education Agency (TEA) developed Bluebonnet Learning instructional materials for mathematics to provide teachers with coherent scope and sequence, daily lesson plans, and student resources that fully cover state standards for grades 6–8 mathematics. These materials are openly accessible and designed to be high-quality, grade-level appropriate resources aligned with the Texas Essential Knowledge and Skills (TEKS) and English Language Proficiency Standards (ELPS) for mathematics instruction. All Bluebonnet Learning mathematics materials were approved through the state's instructional materials review process for use beginning in the 2025–26 school year (Texas Education Agency, 2025).

Research consistently demonstrates that higher levels of engagement are associated with better mathematics performance. Fredricks et al. (2004) conceptualized engagement as multidimensional and found that students who are behaviorally and cognitively engaged tend to achieve at higher levels academically. Zhang and Zhou (2023) reported a significant positive correlation between students' mathematics engagement and their academic performance, highlighting the importance of cognitive investment in learning tasks. Sen (2022) similarly found

that engagement predicts persistence and achievement in middle school mathematics classrooms. These studies underscore the theoretical and empirical importance of engagement as a key factor in mathematics learning, suggesting that instructional design and materials that better support engagement could contribute to more favorable academic outcomes.

Despite substantial research on engagement and mathematics performance overall, there is a lack of empirical evidence examining how engagement with specific state-adopted instructional materials, such as Bluebonnet Learning, relates to student outcomes in mathematics. While the focus in policy and curriculum documentation has been on *standards alignment, usability, and resource completeness*, the literature rarely addresses whether students' engagement with these materials correlates with measurable academic performance. This gap is significant because instructional materials that are widely adopted may influence classroom interaction, motivation, and time on task—factors linked to achievement—yet these effects have not been systematically examined in peer-reviewed research.

To address this gap, the present study investigates the correlation between middle school students' engagement with Bluebonnet Learning mathematics materials and their academic performance in mathematics. The purpose of this study is to determine whether higher levels of engagement with Bluebonnet Learning resources are associated with higher mathematics performance on standardized assessments. By illuminating the relationship between engagement and performance within the specific context of a state-developed, standards-aligned curriculum, this research aims to contribute empirical evidence to the field of mathematics education and inform instructional decision-making in middle school classrooms.

METHODS

Research Design. This study employed a correlational research design to examine the relationship between middle school students' engagement in Bluebonnet Learning mathematics materials and their academic performance. A correlational design was deemed appropriate because it allows researchers to determine the strength and direction of the association between variables without manipulating them (Creswell & Creswell, 2018). This design facilitated an understanding of how students' engagement levels are related to their performance in mathematics within the natural classroom setting.

Setting. The study was conducted in a middle school in the United States during the first semester of the 2025–2026 academic year. The school implements in-person mathematics instruction using Bluebonnet Learning materials, which provide a structured scope and sequence, daily lesson plans, and student resources aligned with state standards. The setting allowed for direct observation and measurement of student engagement in the classroom while ensuring that all participants had access to the same instructional materials and curriculum.

Participants. A total of 56 eighth-grade students participated in the study. Universal sampling was employed, including all students who met the study's inclusion criteria. To be eligible, students were required to have attended the in-person class, maintain at least 90% attendance, not have an Individualized Education Program (IEP) or diagnosed learning disability, and have parental consent to participate. The final sample included students aged 13 to 14 years ($M = 13.29$, $SD = 0.45$), with 29 females (51.8%) and 27 males (48.2%). Regarding ethnicity, 35 students identified as Hispanic/Latino (62.5%), 15 as African American or Black (26.8%), and 6 as White/Caucasian (10.7%). This approach ensured that the sample accurately represented the eighth-grade classroom population and minimized potential confounding factors that could influence engagement or academic performance.

Instruments. Student engagement was measured using a modified version of the Student Engagement Instrument (SEI; Appleton, Christenson, Kim, & Reschly, 2006), adapted specifically to assess engagement with Bluebonnet Learning mathematics materials. The resulting Student Engagement with Bluebonnet Learning (SEBL) instrument captures three dimensions: behavioral, cognitive, and emotional engagement, while also considering the teacher's role in implementing the materials. Behavioral engagement assesses attention, participation, and persistence; cognitive engagement evaluates critical thinking, task relevance, and teacher-supported problem-solving; and emotional engagement measures enjoyment, confidence, interest, and the motivational influence of teacher guidance.

The SEBL instrument underwent expert validation by three mathematics education specialists, who rated each item on a 4-point relevance scale. Item-level Content Validity Index (I-CVI) values ranged from 0.78 to 1.0, and the Scale-level Content Validity Index (S-CVI/Ave) was 0.92, indicating excellent content validity. Pilot testing with a small group of middle school students (n = 12) yielded a Cronbach's alpha of 0.87, demonstrating high internal consistency reliability.

Academic performance was assessed using a teacher-made midterm examination covering mathematics topics taught with Bluebonnet Learning materials. Two mathematics education specialists independently reviewed the assessment for relevance, clarity, and alignment with the Texas Essential Knowledge and Skills (TEKS). I-CVI values ranged from 0.83 to 1.0, with an S-CVI/Ave of 0.91, indicating excellent content validity. Pilot testing produced a Cronbach's alpha of 0.85, confirming consistent measurement of students' mathematics performance.

Data Collection. Prior to data collection, approval was obtained from the school head, and parental consent was secured for all participants. Data collection occurred over 10 days at the end of the first semester of the 2025–2026 school year. Engagement surveys were administered during class sessions, and midterm examination scores were obtained from school records. Collecting data at the same point in time ensured consistency across participants and minimized potential variations due to instructional pacing or classroom differences.

Data Analysis. Descriptive statistics, including means and standard deviations, were computed to summarize students' engagement scores and mathematics performance. Pearson's correlation coefficient was then calculated to determine the strength and direction of the relationship between engagement and academic performance, with an alpha level of significance set at 0.05 (Cohen, 1988). To further investigate the unique contributions of behavioral, cognitive, and emotional engagement to mathematics performance, a multiple regression analysis was conducted, with mathematics performance as the dependent variable and the three engagement domains entered simultaneously as independent variables.

Ethical Considerations. Ethical procedures were strictly observed throughout the study to ensure the confidentiality, privacy, and safety of participants. All student data were anonymized using unique codes, and no identifying information was included in the analysis or reporting of results. Participation was voluntary, and students were informed that they could withdraw from the study at any time without penalty. All procedures adhered to ethical guidelines for research involving human participants, in accordance with the American Psychological Association's standards (APA, 2020).

RESULTS

This section presents the findings of the study, including descriptive statistics and correlational analyses examining the relationship between middle school students' engagement with Bluebonnet Learning mathematics materials and their academic performance. Descriptive analyses summarize students' behavioral, cognitive, and emotional engagement, overall engagement, and mathematics performance, while Pearson correlation analyses examine the direction and strength of the relationships between engagement domains and performance outcomes.

Student Engagement with Bluebonnet Learning

Descriptive statistics for the Student Engagement with Bluebonnet Learning (SEBL) instrument are presented in Table 1.

Table 1 Descriptive Statistics of Student Engagement with Bluebonnet Learning

Variable	Mean	SD	Descriptive Equivalent
Behavioral Engagement	3.11	0.53	Moderately Engaged

Cognitive Engagement	3.27	0.48	Moderately Engaged
Emotional Engagement	3.01	0.55	Moderately Engaged
Overall SEBL Engagement	3.13	0.50	Moderately Engaged

Note. N=56. Engagement Level Scale: 1.00-1.99 – Not Engaged; 2.00-2.49 – Minimally Engaged; 2.50-3.49 – Moderately Engaged, 3.50-4.00 – Highly Engaged.

Overall, students demonstrated moderate to relatively high levels of engagement across all domains. Among the three engagement dimensions, cognitive engagement yielded the highest mean score (M = 3.27, SD = 0.48), indicating that students were generally invested in understanding mathematical concepts, applying strategies, and engaging in higher-order thinking while using Bluebonnet Learning materials. Behavioral engagement (M = 3.11, SD = 0.53) and emotional engagement (M = 3.01, SD = 0.55) also fell within the *Moderately Engaged* range, suggesting consistent participation and generally positive emotional responses during mathematics instruction.

The overall SEBL engagement score averaged 3.13 (SD = 0.50), reflecting a moderate level of engagement across domains. While students demonstrated regular interaction with the instructional materials, the results indicate that engagement was not uniformly high across all dimensions. This pattern suggests potential variability in how students behaviorally participate, cognitively process content, and emotionally respond to the learning experience.

Mathematics Performance

Descriptive statistics for mathematics performance are presented in Table 2.

Table 2 Descriptive Statistics of Students' Mathematics Performance

Variable	Mean	SD	Descriptive Equivalent
Mathematics Performance	76.82	11.50	Satisfactory

Note. N=56. Academic Performance Levels: 0-59 – Failing, 60-69 – Needs Improvement, 70-84 – Satisfactory, 85-100 – Excellent.

Mathematics performance scores ranged from 55 to 98, with a mean of 76.82 (SD = 11.50), corresponding to a *Satisfactory* level of performance. The spread of scores indicates meaningful variability in student outcomes, suggesting that while many students met grade-level expectations, others performed below or above this range.

Correlation Between Engagement and Mathematics Performance

Pearson correlation analysis was conducted to examine the relationship between engagement domains and mathematics performance. The results are shown in Table 3.

Table 3 Pearson Correlation Between SEBL Engagement Domains and Mathematics Performance

Variable	Behavioral	Cognitive	Emotional	Overall Engagement
Mathematics Performance	.48**	.56**	.42**	.54**

Note. N = 56. **p < .05.

As shown in Table 3, all engagement domains were positively and significantly correlated with mathematics

performance. Cognitive engagement showed the strongest relationship with performance ($r = .56$, $p < .01$), followed by overall engagement ($r = .54$, $p < .01$), behavioral engagement ($r = .48$, $p < .01$), and emotional engagement ($r = .42$, $p < .01$). These results indicate that students who are more engaged in cognitive, behavioral, and emotional aspects of learning using Bluebonnet Learning materials tend to perform better academically. This finding is consistent with prior research highlighting the predictive value of multidimensional engagement on mathematics achievement (Fredricks et al., 2004; Maamin et al., 2021; Zhang & Zhou, 2023; Sen, 2022).

Multiple Regression Analysis

A multiple regression analysis was conducted to examine the unique contributions of behavioral, cognitive, and emotional engagement to mathematics performance. Mathematics performance served as the dependent variable, and the three engagement domains were entered simultaneously as independent variables.

Table 4 Multiple Regression Predicting Mathematics Performance from Engagement Domains

Predictor	Unstandardized Coefficients		β	t	p
	B	SE			
Behavioral Engagement	4.12	2.54	.21	1.62	.111
Cognitive Engagement	6.85	2.09	.41	3.28	.002*
Emotional Engagement	3.01	2.76	.14	1.09	.281

Note. $R^2 = .36$, Adjusted $R^2 = .32$. $p < .05$.

The overall regression model was statistically significant, $F(3, 52) = 9.87$, $p < .001$, explaining 36% of the variance in mathematics performance ($R^2 = .36$, adjusted $R^2 = .32$). Cognitive engagement emerged as a statistically significant unique predictor of mathematics performance ($\beta = .41$, $t = 3.28$, $p = .002$). Behavioral engagement showed a positive but non-significant unique contribution ($\beta = .21$, $t = 1.62$, $p = .111$), and emotional engagement was not a significant predictor when controlling for the other engagement domains ($\beta = .14$, $t = 1.09$, $p = .281$).

These results indicate that while all engagement domains are positively associated with mathematics performance, cognitive engagement accounts for the largest proportion of unique variance in student performance when the domains are considered simultaneously.

DISCUSSION

The results of this study support a positive relationship between student engagement with Bluebonnet Learning materials and academic performance in mathematics. The significant positive correlation between engagement and achievement is consistent with prior empirical research showing that engagement contributes to higher mathematics performance (Zhang & Zhou, 2023; Maamin et al., 2021; Fredricks et al., 2004). Cognitive engagement, in particular, emerged as a strong correlate of achievement, a pattern also observed in large samples of secondary students (Zhang & Zhou, 2023) and in studies emphasizing cognitive involvement in meaningful problem solving (Sen, 2022). This suggests that deeper intellectual investment during Bluebonnet Learning tasks may facilitate more robust conceptual understanding and higher performance on assessments.

Behavioral and emotional engagement also correlated positively with achievement. These findings align with engagement frameworks that posit behavioral persistence, on-task involvement, enjoyment, and interest are integral to successful mathematics learning (Fredricks et al., 2004; Maamin et al., 2021). Emotional engagement's contribution suggests that fostering interest and confidence within math lessons, components addressed through culturally responsive and interactive materials, can support performance gains, a conclusion reinforced by research in similar contexts (Alrajeh & Shindel, 2020; Maamin et al., 2021).

Importantly, the role of teacher support emerged as a salient factor in students' engagement and achievement. The findings that perceived teacher support correlated with both engagement and mathematics outcomes correspond with literature showing that active teacher involvement, instructional scaffolding, and supportive teacher–student relationships significantly influence engagement and achievement (Alrajeh & Shindel, 2020; Yang et al., 2021; Shen, 2024; Huang et al., 2023). This supports theoretical perspectives that social and instructional support are proximal determinants of engagement and create conditions conducive to meaningful learning (Fredricks et al., 2004; Maamin et al., 2021).

The positive correlations observed in this study have important implications for educators. They underscore the value of structuring mathematics instruction to enhance multiple dimensions of engagement—behavioral, cognitive, and emotional—particularly when using standards-aligned curricular resources like Bluebonnet Learning. Teacher strategies that reinforce task relevance, encourage participation, and support students affectively can contribute to stronger engagement and achievement, as seen in a range of educational contexts (Alrajeh & Shindel, 2020; Shen, 2024; Yang et al., 2021; Maamin et al., 2021).

Additionally, this research contributes to the literature by providing context-specific evidence that engagement measured through a validated instrument adapted for Bluebonnet Learning is predictive of academic outcomes. This addresses a gap noted in previous studies that often treat engagement and achievement as broad constructs without linking them to specific instructional materials, providing practical insights for middle school mathematics instruction (Zhang & Zhou, 2023; Maamin et al., 2021; Sen, 2022).

Limitations and Future Research. Although statistically significant correlations were identified, the study's correlational design does not establish causation. Longitudinal or experimental research could further elucidate causal mechanisms linking engagement with instructional materials and mathematics performance. Additionally, future research could explore mediating factors (e.g., self-efficacy) and differential effects across subgroups (e.g., by gender or baseline achievement), as suggested by broader educational research (Yang et al., 2021; Huang et al., 2023; Fredricks et al., 2004).

CONCLUSION

The findings of this study indicate that middle school students' engagement with Bluebonnet Learning mathematics materials is positively associated with academic performance. Cognitive engagement emerged as the strongest predictor of achievement, suggesting that students who actively process, analyze, and apply mathematical concepts tend to perform at higher levels. Behavioral and emotional engagement also contributed positively, underscoring the importance of participation, persistence, interest, and confidence in learning. Teacher support played a critical role in facilitating engagement, highlighting the value of instructional scaffolding and affective guidance in promoting student learning outcomes. Together, these results provide empirical support for the use of structured, standards-aligned instructional materials to enhance multidimensional engagement and academic success in middle school mathematics.

Despite these promising findings, the study's single-school design and relatively small sample limit the generalizability of the results. Additionally, the reliance on self-reported engagement and a single measure of academic performance introduces potential bias. Future research should explore longitudinal or multi-site designs to examine the stability of these relationships over time and across diverse contexts. Investigating a mediation model in which self-efficacy explains the link between cognitive engagement and mathematics achievement, with teacher support as a potential moderator, could provide deeper insight into the mechanisms underlying student learning. Such work would also clarify whether these effects vary across student subgroups, offering guidance for targeted instructional strategies that maximize engagement and performance.

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