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Original Article

Influence of Mathematical Beliefs, Attitudes and Emotions on Mathematics Performance of Senior High School Students

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Abstract. This study examined the relationships between the affective domains of mathematics (beliefs, attitudes, and emotions) and mathematics performance among 69 senior high school students from a technical-vocational school in Digos City, Davao del Sur. A predictive correlational design was employed using a validated questionnaire to measure affective domains and final grades in General Mathematics to assess performance. Normality testing revealed that the data did not meet parametric assumptions, necessitating the use of non-parametric statistical procedures. Results showed that students demonstrated high levels of affective engagement, with beliefs (M = 3.41), attitudes (M = 3.42), and emotions (M = 3.53) all rated highly, while mathematics performance was very satisfactory (M = 89.55). Spearman's rho correlation analysis indicated that beliefs had a moderate, positive, significant relationship with performance (r_s = .438, p < .001), attitudes exhibited a weak, positive, significant relationship (r_s = .240, p = .047), and emotions showed no significant correlation (r_s = .108, p = .378). Multiple regression analysis with the bootstrap technique revealed that affective domains collectively predicted mathematics performance (p < .001, R^2 = .249), with beliefs emerging as the strongest predictor (β = .674, p < .001). Unexpectedly, emotions showed a significant negative relationship with performance (β = -.407, p = .015) after controlling for other variables, whereas attitudes contributed no unique predictive power (β = .023, p = .905). These findings suggest that fostering positive mathematical beliefs can create pathways for enhanced student performance in mathematics. These results offer valuable insights for educators seeking to support students holistically by nurturing both cognitive skills and affective engagement, ultimately promoting more meaningful and successful mathematics learning experiences.

Keywords: *Attitudes; Beliefs; Emotions; Mathematics performance.*

Mathematics is often regarded as a fundamental subject that plays a crucial role in various fields of study and the development of critical thinking and problem-solving skills. Despite this, many students struggled to grasp mathematical concepts due to their behavioral responses toward mathematics (Bacong et al., 2023). Moreover, an area of increasing focus in mathematics education is the affective domain and its impact on teaching and learning processes, which, in turn, leads to various models of its constituencies and modifying factors (Beltrán-Pellicer & Godino, 2020).

Globally, recent studies have identified multiple factors influencing mathematics performance among high school students, including personal circumstances, misconceptions, issues related to students, teachers, teaching methods, language skills, educational resources, parental and family support, school environments, policies, societal influences, infrastructure, and government involvement (Guinocor et al., 2020). Furthermore, the affective domain and socio-emotional learning competencies have been increasingly recognized for their significant impact on academic achievement, particularly in mathematics, as emotional engagement and social-emotional skills influence students' motivation, perseverance, and academic performance (Ogoy & Comahig, 2025).

In the Philippines, Llagas (2021) found that prospective teachers demonstrated positive overall disposition to mathematics, with the cognitive, affective, and conative aspects all receiving positive ratings. This Philippine-based study highlights that developing mathematical dispositions encompassing behavioral, cognitive, and affective tendencies is crucial for learning mathematics and making informed decisions. Locally, Callaman and Itaas (2020) recommended that teachers develop positive attitudes towards mathematics learning. Furthermore, a recent study found that psychological factors, including attitude, learning engagement, motivation, and self-efficacy, as well as instructional factors such as teacher-related factors and the learning environment, significantly influenced college students' performance in higher mathematics (Guinocor et al., 2020). Moreover, mathematics achievement is influenced not only by cognitive ability but also by psychological and emotional factors such as self-esteem and mathematics anxiety, with anxiety playing a moderating role that can weaken the effect of self-esteem on achievement (Peteros et al., 2025).

These suggest that beliefs about one's own abilities (Hidayatullah & Csíkos, 2024), attitudes towards learning (Shah et al., 2023; Wakhata et al., 2024), and emotions (Pekrun, 2024; Schoenherr et al., 2025) significantly impact students' performance in mathematics. When students feel positive about math, they tend to perform better; on the other hand, negative feelings can cause them to avoid math and lead to anxiety-related challenges (Ogoy & Comahig, 2025). Therefore, it is important to understand how these affective domains influence students' math performance. Many students continue to struggle with mathematics; most studies focus on teaching methods and general factors such as math anxiety and emotional factors (Schoenherr et al., 2025). However, limited studies examine how the affective domains, such as beliefs, emotions, and attitudes, are examined in the local context. Thus, this study aims to fill the gap by exploring how these affective domains affect senior high school students' performance in mathematics.

In light of the identified gap, this study seeks to explore the affective and cognitive dimensions of senior high school students. Specifically, it aims to assess students' affective domains in mathematics, including their beliefs, emotions, and attitudes toward the subject. Additionally, the study will assess students' level of mathematics performance. By examining the influence of affective domains on mathematical performance, the study aims to determine how beliefs, emotions, and attitudes affect students' performance in mathematics. Understanding this can help teachers design strategies that not only strengthen mathematical skills but also cultivate affective aspects, thereby enhancing students' overall performance and engagement in mathematics.

Methodology

Research Design

A predictive correlational design was employed in this study. This non-experimental quantitative research design is appropriate when the goal is to identify predictive relationships between predictor variables and an outcome or criterion variable without manipulating any variables (Curtis et al., 2016). In this study, the predictive correlational design serves multiple purposes. First, it describes the existing levels of students' affective domains (beliefs, emotions, and attitudes) and mathematics performance through descriptive statistics. Second, it examines the strength and direction of relationships between these variables through correlation analysis. Third, and most importantly, it develops a predictive model using regression analysis to determine which affective domain variables are significant predictors of mathematics performance and to what extent they can predict student achievement outcomes.

Respondents and Sampling Technique

The study involved 69 senior high school students from a technical-vocational school in Digos City, Davao del

Sur: 20 from Accountancy, Business, and Management (ABM), 30 from Humanities and Social Sciences (HUMSS), and 19 from Technical-Vocational-Livelihood (TVL). Only students enrolled in the General Mathematics subject during the school year 2024–2025 were included in the study. Stratified random sampling was employed to determine the sample size and ensure proportional representation of each academic strand. Using Slovin's formula with a margin of error of 0.05, a sample size of 69 respondents was computed from the total population of 83 students. The samples were proportionately allocated across the strands to maintain representativeness, thereby enhancing the reliability and validity of the study findings.

Research Instrument

To determine the level of the affective domain among senior high school students, this study used an adapted questionnaire developed by Prada Núñez et al. (2024). The instrument measures three indicators of the affective domain: beliefs, attitudes, and emotions. Reliability analysis revealed that the beliefs indicator obtained a Cronbach's alpha coefficient of .86, indicating good internal consistency. The attitudes indicator yielded a Cronbach's alpha of .89, while the emotions indicator recorded a Cronbach's alpha of .88, both of which also reflect high reliability of the instrument. A five-point Likert scale was employed to interpret the respondents' level of affective domain across all indicators, where mean scores ranging from 4.21–5.00 were interpreted as Very High, 3.41–4.20 as High, 2.61–3.40 as Moderately High, 1.81–2.60 as Low, and 1.00–1.80 as Very Low. This scale provided a consistent basis for evaluating students' affective responses, including beliefs, attitudes, and emotions. Meanwhile, to assess students' mathematics performance, this study used their final grades in the General Mathematics subject. The grading system employed was anchored on the standards prescribed in DepEd Order No. 8, s. 2015. Consistent with the study of Panlaan (2019), students' performance was described using the grading scale presented in Table 10, where grades ranging from 90–100 were interpreted as Outstanding, 85–89 as Very Satisfactory, 80–84 as Satisfactory, 75–79 as Fairly Satisfactory, and grades below 75 as Did Not Meet Expectations. This grading scale served as the basis for classifying students' mathematics performance levels in the study.

Data Gathering Procedure

To formally initiate the study, the researcher sent a letter to the school principal requesting permission to survey the students. After approval, the researcher seeks the assistance of the students' mathematics teacher in administering the research instrument and scheduling the survey sessions. The researcher also requested copies of the respondents' General Mathematics grades to complement the study. Subsequently, the research instrument was distributed to the students and later collected after completion. Finally, to ensure ethical standards, the confidentiality of all respondents was maintained, and their information was used solely for the study.

Data Analysis

Descriptive statistics were used to summarize the data and describe the levels of students' affective mathematical domains (beliefs, emotions, and attitudes) and mathematics performance. Due to the non-normal distribution of the data, the mean was interpreted with caution and supported by appropriate measures of variability. For inferential analysis, non-parametric statistical techniques were applied. Spearman's rank-order correlation was used to examine the strength and direction of the relationships between the affective domain variables and mathematics performance. To determine the combined influence of beliefs, emotions, and attitudes on students' mathematics performance, multiple regression analysis with the bootstrap technique was employed.

Ethical Considerations

During the conduct, several ethical considerations were strictly observed. Informed consent was ensured by having all respondents sign a form explaining the purpose of the study, potential risks and benefits, the confidentiality of their data, and their right to withdraw at any time without penalty. Confidentiality was maintained by securely storing all collected information in a location accessible only to the researcher, protecting respondents' privacy. Anonymity was also guaranteed, with respondents' identities and personal information kept private and not disclosed publicly. Furthermore, the study was designed to prevent potential harm and emphasized that participation was entirely voluntary. Respondents were free to skip any questions they preferred not to answer and could withdraw from the study at any point without providing a reason, ensuring that their rights and well-being were fully respected throughout the research process.

Results and Discussion

Level of Mathematical Affective Domains of Senior High School Students

The overall level of the mathematical affective domain of senior high school students is presented in Table 1. The overall mean of this variable is 3.46, which is described as high. This indicates that students generally demonstrate positive affective perceptions of mathematics, characterized by relatively consistent enjoyment and confidence, though their motivation and attitudes may fluctuate with contextual factors. This finding suggests that while students exhibit favorable emotional orientations toward mathematics, there remains room for strengthening their affective engagement (Pinxten et al., 2022). Furthermore, this demonstrates that students' emotional connections to mathematics can be situational, and educators may need to employ diverse pedagogical strategies to sustain motivation and confidence consistently throughout instruction (Ramirez et al., 2023).

Table 1. *Level of Affective Domain of Senior High School Students Towards Mathematics*

Indicators	*M*	*SD*	Description
Beliefs	3.41	0.64	High
Attitudes	3.42	0.70	High
Emotions	3.53	0.80	High
Overall	**3.46**	**0.65**	**High**

The data further reveal that senior high school students' beliefs toward mathematics had a mean of 3.41, indicating a high level. This implies that students generally hold positive perceptions in the mathematical affective domain, demonstrating consistent confidence in their mathematical abilities and belief in the value of mathematics (Beltrán-Pellicer & Godino, 2020). Moreover, the attitudes domain recorded a mean score of 3.42, which is also considered high, indicating that students generally maintain positive attitudes toward mathematics and are more engaged when instructional approaches are clear, structured, and supportive (Thien et al., 2020). Finally, emotions had the highest mean across the three domains at 3.53, which is considered high. This indicates that senior high school students associate successful mathematical problem-solving with pronounced positive emotions. Their emotional responses suggest that engaging with and solving mathematical problems elicits joy, satisfaction, and a sense of accomplishment, which are critical components of mathematical learning and persistence (Hannula et al., 2020).

Level of Mathematics Performance of Senior High School Students

The level of mathematics performance of senior high school students is presented in Table 2. The overall mean score is 89.55, with a standard deviation of 3.53, which is considered very satisfactory. This indicates that students demonstrate strong mathematical proficiency and have achieved a high level of mathematical competency. This result suggests that students have successfully mastered the essential mathematical concepts and skills required at the senior high school level, reflecting effective learning outcomes (Suárez-Álvarez et al., 2021). The very satisfactory performance indicates that most students possess solid foundational knowledge and can apply mathematical procedures and problem-solving strategies with considerable accuracy and consistency (Schoenfeld, 2020).

Table 2. *Level of Mathematics Performance of Senior High School Students*

	M	*S*	Description
Mathematics Performance	89.55	3.53	Very Satisfactory

Relationship of Mathematical Affective Domains and Mathematics Performance

The results reveal that beliefs toward mathematics demonstrated a moderate, positive, and significant relationship with mathematics performance (r_s = .438, p < .000). This indicates that students who hold stronger beliefs about their mathematical abilities and the value of mathematics tend to achieve higher performance levels. This finding aligns with recent research showing that mathematical beliefs, particularly self-efficacy and confidence in one's mathematical abilities, are important predictors of academic achievement (Liu et al., 2024). The moderate correlation suggests that students' conviction in their ability to succeed in mathematics and their perception of mathematics as valuable and meaningful significantly influence their actual mathematical performance (Ceballos et al., 2024).

Similarly, attitudes toward mathematics showed a weak, positive, significant relationship with mathematics performance (r_s = .240, p = .047). Although the correlation is weak, it remains statistically significant, indicating that students who maintain more positive attitudes toward mathematics tend to perform better academically. This

suggests that favorable dispositions toward mathematics, including interest, appreciation, and willingness to engage with mathematical tasks, contribute to improved performance outcomes, albeit to a lesser extent than beliefs (Wakhata et al., 2024). The weaker correlation may indicate that, while positive attitudes are beneficial, other factors, such as cognitive abilities, instructional quality, and prior knowledge, may play a more substantial role in determining performance (Marth et al., 2024).

Table 3. *Relationship of Mathematical Affective Domains and Mathematics Performance*

	Mathematics Performance		
	r_s	p	**Remarks**
Beliefs	.438	< .001	Significant
Attitudes	.240	.047	Significant
Emotions	.108	.378	Not Significant

In contrast, emotions toward mathematics were not significantly related to mathematics performance (r_s = .108, p = .378). This non-significant finding suggests that emotional responses to mathematics, such as enjoyment, anxiety, or frustration, do not directly predict performance levels among senior high school students in this sample. While this result may seem counterintuitive given the theoretical importance of emotions in learning, it aligns with recent research indicating that the relationship between mathematical emotions and performance can be complex and context-dependent (Schoenherr et al., 2025). The lack of a significant correlation may also suggest that high-performing students can regulate their emotions effectively, or that emotional experiences do not consistently translate into performance differences across students (Sydänmaanlakka et al., 2024). Additionally, emotions may indirectly affect performance by influencing beliefs and attitudes, rather than exerting direct effects on achievement outcomes (Chen, 2024).

Influence of Mathematical Affective Domains on Mathematics Performance of Senior High School Students

The regression model was statistically significant, F(3, 65) = 7.197, p < .001, indicating that the mathematical affective domains collectively predict mathematics performance. The model explained 24.9% of the variance in mathematics performance (R^2 = .249), with an adjusted R^2 of .215, suggesting that approximately 21.5% of the variance can be attributed to the combined effect of beliefs, attitudes, and emotions when accounting for the number of predictors (Liu et al., 2024). This moderate effect size indicates that affective factors play a meaningful role in determining mathematics achievement, though other cognitive and contextual variables likely contribute to the remaining variance (Marth et al., 2024).

Among the three affective domains, beliefs emerged as the strongest and most significant predictor of mathematics performance (β = .674, t = 3.667, p < .001). The positive standardized coefficient indicates that for every one-standard-deviation increase in mathematical beliefs, mathematics performance increases by approximately 0.674 standard deviations, holding other variables constant. This substantial effect underscores the critical importance of students' beliefs about their mathematical capabilities and the value they place on mathematics in determining academic success (Ceballos et al., 2024). Students who maintain strong self-efficacy, confidence in their problem-solving abilities, and conviction that mathematics is worthwhile demonstrate significantly higher achievement levels, supporting theoretical frameworks that position beliefs as foundational to learning (Chen, 2024).

Table 4. *Influence of Mathematical Affective Domains on Mathematics Performance*

Predictor	***B***	***SE***	***β***	***t***	***p***
Constant	82.726	2.121	—	39.004	< .001
Beliefs	3.739	1.020	.674	3.667	< .001
Attitudes	0.115	0.963	.023	0.120	.905
Emotions	−1.797	0.719	−.407	−2.500	.015

Note. *R = .499, R^2 = .249, adjusted R^2 = .215. F(3, 65) = 7.197, p < .001. Dependent variable: Mathematics performance*

Interestingly, attitudes toward mathematics did not significantly predict mathematics performance (β = .023, t = 0.120, p = .905). Despite a weakly significant bivariate correlation, attitudes failed to add unique predictive power when controlling for beliefs and emotions in the regression model. This suggests that the influence of attitudes may be mediated or confounded by beliefs, or that attitudes operate through indirect pathways rather than directly affecting performance (Sydänmaanlakka et al., 2024). The negligible standardized coefficient indicates that variations in attitudes have minimal impact on performance when other affective factors are held constant

(Wakhata et al., 2024).

Surprisingly, emotions demonstrated a significant negative relationship with mathematics performance ($\beta = -.407$, $t = -2.500$, $p = .015$). This unexpected finding suggests that higher emotional responses to mathematics are associated with lower performance outcomes. Several factors may explain this counterintuitive result. First, the emotions measured may have included both positive and negative affective states. If negative emotions such as anxiety, frustration, or fear were more prevalent or more intense than positive emotions like enjoyment and pride, the overall emotional score could be inversely related to achievement (Schoenherr et al., 2025). Second, students who experience heightened emotional reactions to mathematics, whether positive or negative, may face difficulties with emotional regulation that interfere with cognitive processing and problem-solving efficiency (Szczygieł, 2020). Third, the negative coefficient may reflect a suppression effect in the regression model, in which the relationship between emotions and performance is altered when controlling for beliefs and attitudes, revealing complex interactions among affective variables (Parhiala et al., 2024).

Conclusion

This study examined the relationships between affective domains of mathematics and mathematics performance among senior high school students. The findings revealed that students demonstrated high levels of positive engagement across beliefs, attitudes, and emotions, while achieving very satisfactory mathematics performance. The correlational analyses indicated that these affective domains relate to performance in distinct ways. Beliefs showed a moderate positive association with achievement, attitudes showed a weak positive association, and emotions showed no significant direct correlation with performance. The regression analysis provided more profound insight into these relationships, showing that beliefs were the strongest predictor of mathematics performance, while attitudes contributed minimal unique explanatory power. Notably, emotions demonstrated an unexpected negative relationship with performance when other affective variables were controlled, suggesting that the interplay among affective constructs and their associations with achievement are more complex than simplistic models might suggest. These findings underscore the multidimensional nature of mathematical affect and highlight the importance of examining these domains simultaneously rather than in isolation.

The correlational design of this study limits conclusions to associations rather than causal relationships. While significant connections were observed between affective variables and performance, the directionality of these relationships remains uncertain. It is equally plausible that successful performance strengthens positive beliefs and attitudes as it is that favorable affective orientations support achievement. Moreover, the affective domains examined accounted for approximately one-quarter of the variance in mathematics performance, indicating that cognitive factors, instructional quality, prior knowledge, and socioeconomic contexts likely interact with affective variables in determining achievement outcomes. The counterintuitive negative relationship between emotions and performance particularly warrants further investigation, as it challenges conventional assumptions and may reflect suppression effects or complex interactions not fully captured in this analysis. Future research employing longitudinal designs or experimental interventions would be necessary to establish causal mechanisms and to disaggregate the specific emotional experiences that relate positively or negatively to mathematical achievement across different learning contexts.

Despite these limitations, the study offers meaningful considerations for educational practice and policy. The robust association between mathematical beliefs and performance suggests that interventions to strengthen students' confidence and self-efficacy may be worthwhile educational investments. However, experimental validation would be needed to confirm causal impacts. Educators might benefit from implementing comprehensive approaches that address multiple affective dimensions simultaneously, recognizing that beliefs, attitudes, and emotions interact in shaping student experiences and outcomes. Teacher preparation programs could incorporate training in strategies to build mathematical self-efficacy while supporting productive emotional engagement during instruction. Policymakers might consider supporting professional development initiatives and curriculum frameworks that acknowledge the role of affective factors alongside cognitive skill development in mathematics education. This study contributes to the growing body of evidence examining how students' psychological orientations toward mathematics relate to their academic achievement, while emphasizing the need for continued research to untangle the complex, bidirectional, and context-dependent relationships between affective engagement and performance in mathematics learning.

Contributions of Authors

Author 1: conceptualization, data gathering, writing – original draft
Author 2: conceptualization, data analysis, checking, and editing

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Conflict of Interests

No conflict of interest.

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