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THE RELATIONSHIP BETWEEN ATTITUDES TOWARD MATHEMATICS AND ACADEMIC ACHIEVEMENT OF STUDENTS AS MEDIATED BY FEEDBACK LITERACY

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ABSTRACT

This study examined the relationship between attitudes toward mathematics and students' academic achievement, with feedback literacy explored as a potential mediating variable. A descriptive-correlational research design employing mediation analysis was utilized among Third-Year Bachelor of Elementary Education (BEED-Generalist) students during the First Semester of the Academic Year 2025–2026. Data were collected using standardized instruments measuring attitudes toward mathematics, feedback literacy, and mathematics achievement. Results revealed that students demonstrated a generally positive attitude toward mathematics, with high levels of value, sense of security, motivation, and enjoyment. However, mathematics achievement was described as fair. Students also exhibited a very highly extensive level of feedback literacy across all dimensions, including appreciation, positive attitude, awareness of effective feedback, and openness to using feedback. Correlation analysis indicated a significant relationship between attitudes toward mathematics and academic achievement, as well as between attitudes toward mathematics and feedback literacy. In contrast, feedback literacy was not significantly related to academic achievement. Mediation analysis further showed that while attitudes toward mathematics significantly predicted feedback literacy, feedback literacy did not significantly predict academic achievement and did not mediate the relationship between attitudes toward mathematics and academic achievement. These findings suggest that although students possess positive mathematical attitudes and high feedback literacy, these factors do not automatically translate into higher academic achievement. The study highlights the need for instructional strategies that strengthen the functional use of feedback and enhance instructional practices to better convert positive attitudes into improved mathematics achievement.

KEYWORDS: *Mathematics Education, Attitudes Toward Mathematics, Mathematics Achievement, Feedback Literacy, Mediation Analysis, Higher Education Students*

INTRODUCTION

Mathematics academic achievement remains a significant concern in education, particularly in teacher education programs where future teachers are expected to demonstrate strong foundational competence. Pre-service teachers in the Bachelor of Elementary Education (BEED) program must possess adequate numerical proficiency to effectively teach mathematics, especially within the spiral progression approach mandated in the K–12 curriculum by the Department of Education (DepEd) (Rubio & Saenz, 2023). However, declining mathematics performance has been widely documented across countries. International assessments such as the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA) have reported persistent learning gaps and declining mathematics achievement across several nations (Laukaityte et al., 2024).

In the Philippines, results from PISA 2022 revealed low levels of mathematics proficiency among Filipino learners, highlighting continuing challenges in conceptual understanding, problem-solving, and higher-order thinking skills (Ceballos et al., 2025). Similar concerns are observed at the tertiary level and in local contexts such as Davao del Norte, where studies report only moderate mathematics achievement among college students, indicating gaps in mastery of mathematical concepts (Gahi et al., 2023).

While previous research has largely focused on instructional and cognitive factors influencing achievement, limited studies have examined affective and metacognitive variables. In particular, empirical evidence remains scarce on whether feedback literacy mediates the relationship between students' attitudes toward mathematics and their academic achievement. Addressing this gap provides important insights that may inform improvements in feedback practices, strengthen mathematics instruction, and enhance the preparation of future teachers.

OBJECTIVES

1. To determine level of attitudes toward mathematics of the students in terms of value, sense of security, motivation, and enjoyment.
2. To determine level of academic achievement of the students in mathematics.
3. To determine the extent of feedback literacy of the students in terms of appreciation, positive attitude, awareness towards effective feedback, and openness to use feedback.

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4. To determine the relationship between attitudes toward mathematics and academic achievement of the students, feedback literacy and academic achievement of the students, and attitudes toward mathematics and feedback literacy.
5. To assess whether feedback literacy significantly mediates the relationship between attitudes toward mathematics and students' academic achievement.

METHODOLOGY

This study employed a quantitative descriptive–correlational research design. Quantitative research involves the collection and analysis of numerical data to examine relationships among variables, identify patterns, and test hypotheses using statistical techniques (Alex & Alex, 2025). This approach enables researchers to produce objective and generalizable findings through the use of structured instruments and statistical analysis.

The descriptive component was used to characterize the key variables of the study without manipulating them. Specifically, the attitudes toward mathematics, feedback literacy, and academic achievement of third-year BEED-Generalist students were described using descriptive statistical measures such as the mean and standard deviation (Singh, 2024). Meanwhile, the correlational technique was employed to determine the strength and direction of the relationships among attitudes toward mathematics, feedback literacy, and academic achievement. Correlational research examines how variables vary in relation to one another using statistical indicators such as correlation coefficients (Stewart, 2025).

In addition, mediation analysis was conducted to examine whether feedback literacy mediates the relationship between attitudes toward mathematics and academic achievement. Mediation analysis allows researchers to assess both direct and indirect effects among variables using regression-based procedures (Walters & Mandracchia, 2017). This approach helps explain whether the influence of an independent variable on a dependent variable operates through an intervening variable (Rinjhart et al., 2021).
The respondents consisted of third-year Bachelor of Elementary Education (BEED–Generalist) students enrolled during the Academic Year 2025–2026 from three Higher Education Institutions (HEIs) in Davao del Norte offering the BEED program. Using the Raosoft sample size calculator and proportional allocation, a total of 128 respondents were selected from a population of 191 students across the three institutions.

RESULTS

The results revealed that students demonstrated a high level of attitudes toward mathematics (M = 3.70). Among the dimensions, value obtained the highest mean (M = 4.47), indicating that students strongly recognize the usefulness of mathematics in academic and real-life contexts (Bora, 2025). Sense of security (M = 3.41), motivation (M = 3.44), and enjoyment (M = 3.46) were also rated high, suggesting that students generally feel confident, interested, and satisfied when learning mathematics, although some may still experience anxiety (Supriadi et al., 2024). Overall, the findings indicate generally positive attitudes toward mathematics, which may enhance engagement and persistence in learning (Boadu & Boateng, 2024; Weinhandl et al., 2023).

Students' academic achievement in Mathematics in the Modern World obtained a mean score of 51.44%, interpreted as fair (SD = 11.26), indicating that while students possess basic mathematical knowledge, their ability to apply concepts to complex problem-solving tasks remains limited (Molnar & Greiff, 2023; Pelayo et al., 2023).

The findings also revealed a very highly extensive level of feedback literacy (M = 4.54). Among the indicators, awareness toward effective feedback obtained the highest mean (M = 4.71), followed by openness to use feedback (M = 4.55), positive attitude toward feedback (M = 4.47), and appreciation of feedback (M = 4.43). These results indicate that students value, understand, and are willing to apply feedback to improve their learning (Panadero & Lipnevich, 2021; Williams, 2024).

Correlation analysis showed a significant relationship between attitudes toward mathematics and academic achievement ($r = 0.118$, $p = 0.003$), suggesting that students with more positive attitudes tend to demonstrate slightly higher academic performance (Shakya & Maharjan, 2023). However, feedback literacy did not show a significant relationship with academic achievement ($r = -0.025$, $p = 0.777$). In contrast, attitudes toward mathematics were significantly related to feedback literacy ($r = 0.264$, $p = 0.003$), indicating that students with more favorable attitudes toward mathematics are more receptive to feedback (Shen & Chong, 2022).

Finally, mediation analysis revealed that feedback literacy does not significantly mediate the relationship between attitudes toward mathematics and academic achievement. Although attitudes toward mathematics significantly predicted feedback literacy ($\beta = 0.30$, $p < 0.05$), feedback literacy did not significantly predict academic achievement ($\beta = -1.60$, $p = 0.51$), and both the direct effect ($\beta = 3.88$, $p = 0.14$) and indirect effect ($\beta = -0.46$, $p = 0.52$) were not statistically significant. These findings suggest that while positive attitudes toward mathematics enhance students' feedback literacy, feedback literacy does not directly translate into improved academic achievement (Ajjawi et al., 2021).

RECOMMENDATIONS

Based on the findings, several recommendations are proposed. First, since students demonstrated a high level of attitudes toward mathematics, teachers and curriculum planners should continue strengthening positive mathematical attitudes by emphasizing the real-life relevance of mathematics and providing supportive learning environments that enhance students' confidence, motivation, and enjoyment.

Second, given that students' academic achievement in Mathematics in the Modern World was described as fair, schools and teachers may implement targeted instructional interventions such as remedial support, differentiated instruction, and problem-solving activities to strengthen students' conceptual understanding and procedural fluency.

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Third, although students exhibited a very highly extensive level of feedback literacy, it did not significantly predict academic achievement nor mediate its relationship with attitudes toward mathematics. Thus, teachers may improve feedback practices by providing clearer guidance on how students can apply feedback through revision activities, reflection, and follow-up learning tasks.

Finally, future studies may examine other variables that may better explain the relationship between attitudes toward mathematics and academic achievement, such as self-efficacy, learning strategies, or instructional quality. Longitudinal or experimental designs are also recommended to further explore the role of feedback literacy in influencing academic outcomes.

CONCLUSION

The findings revealed that students generally demonstrate positive attitudes toward mathematics, particularly in terms of value, sense of security, motivation, and enjoyment. Despite these favorable attitudes, students' academic achievement in Mathematics in the Modern World was described as satisfactory, indicating adequate foundational knowledge but the need for further improvement in mathematical proficiency.

The results also showed that students exhibit a consistently high level of feedback literacy, reflected in their appreciation of feedback, positive attitudes toward receiving it, awareness of effective feedback characteristics, and openness to using feedback to support learning.

Furthermore, attitudes toward mathematics were significantly related to both academic achievement and feedback literacy, suggesting that students with more positive attitudes tend to demonstrate better academic outcomes and stronger feedback literacy. However, feedback literacy did not show a significant relationship with academic achievement. Mediation analysis also revealed that although attitudes toward mathematics significantly influence feedback literacy, feedback literacy does not mediate the relationship between attitudes toward mathematics and academic achievement, as neither the direct nor indirect effects were statistically significant. These findings indicate that while positive attitudes toward mathematics contribute to the development of feedback literacy, feedback literacy alone does not directly translate into improved academic achievement.

TABLES AND REFERENCES

Table 1. Level of Students' Attitudes Toward Mathematics

Indicators	SD	Mean	Descriptive Equivalent
Value	0.69	4.47	Very High
Sense of Security	1.08	3.41	High
Motivation	1.09	3.44	High
Enjoyment	0.98	3.46	High
Overall Mean	**1.08**	**3.70**	**High**

Table 2. Level of Academic Achievement of the Student in Mathematics

Variable	SD	Mean	Descriptive Equivalent
Academic Achievement	11.26	51.44	Fair

Table 3. Summary on the Extent of Students' Feedback Literacy

Indicators	SD	Mean	Descriptive Equivalent
Appreciation	0.67	4.43	Very Highly Extensive
Positive Attitude	0.64	4.47	Very Highly Extensive
Awareness Towards Effective Feedback	0.65	4.71	Very Highly Extensive
Openness to Use Feedback	0.61	4.55	Very Highly Extensive
Overall Mean	**0.64**	**4.54**	**Very Highly Extensive**

Table 4. Significance of the Relationship Between Attitudes Toward Mathematics, Feedback Literacy and Academic Achievement

Variables Correlated	r	p-value	Decision on H_o	Decision on Relationship
Attitudes Toward Mathematics and Academic Achievement	0.12	0.00	Rejected	Significant
Feedback Literacy and Academic Achievement	-0.03	0.78	Not Rejected	Not Significant
Attitudes Toward Mathematics and Feedback Literacy	0.26	0.00	Rejected	Significant

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Table 5. Regression Weights, Total Effect, Direct Effect and Indirect Effect

				95% Confidence Interval			
Variables	**Label**	**Estimate**	**S.E**			**Z**	**p-value**
				Lower	**Upper**		
Attitudes toward Mathematics→ Feedback Literacy	A	0.30	0.09	0.11	0.47	3.10	0.00
Feeback Literacy→ Academic Achievement	B	−1.60	2.41	−6.32	3.12	−0.66	0.51
Attitudes toward Mathematics → Academic Achievement	c'	3.88	2.65	-1.31	9.06	1.46	0.14
Total Effect	3.41	*Direct Effect*		3.88	*Indirect Effect*		−0.46
p-value	0.18	p-value		0.14	p-value		0.52

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