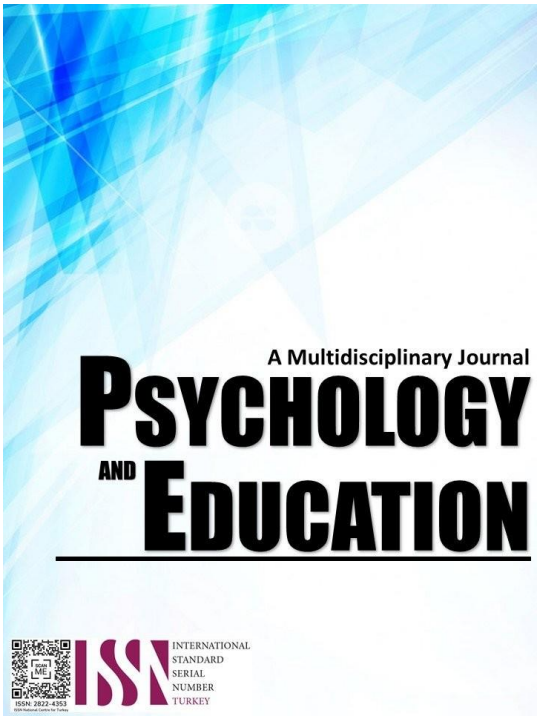
MATH ANXIETY, SELF-EFFICACY, AND MATHEMATICS PERFORMANCE OF HIGH SCHOOL LEARNERS



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Research Article

Math Anxiety, Self-Efficacy, and Mathematics Performance of High School Learners

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Abstract

Results revealed moderate levels of math anxiety among learners, with the highest anxiety associated with practical, real-world mathematical tasks. Self-efficacy levels were generally low, particularly in learners' perceptions of their overall mathematical abilities compared to peers. However, academic performance showed a positive trend, with 71% of learners performing at or above the "Advancing Proficiency" level. Surprisingly, correlational analysis found no significant relationship between mathematics anxiety and academic performance, nor between self-efficacy and academic performance. This suggests that other factors may play a more crucial role in determining academic outcomes in mathematics. The findings highlight the need for contextualized interventions to address math anxiety and boost self-efficacy, particularly in practical applications of mathematics. Recommendations include enhancing self-efficacy through contextualized interventions, improving teaching strategies, creating supportive classroom environments, and regularly monitoring learners' self-efficacy and performance to provide personalized support. This research contributes to the understanding of psychological factors affecting mathematics education in the Philippine context. It emphasizes the importance of addressing both cognitive and affective aspects of learning to improve mathematics education outcomes. Future studies could explore additional factors influencing academic performance and investigate the effectiveness of specific interventions aimed at reducing math anxiety and enhancing self-efficacy in mathematics education.

Keywords: *teaching mathematics, math anxiety, self-efficacy, academic performance*

Introduction

Mathematics plays a crucial role in various fields, including science, engineering, technology, and economics, serving as a tool for problem-solving and logical reasoning (Moore, 2020). It is the foundation of STEM disciplines, and proficiency in mathematics is essential for success in these fields (Ben-Jacob, 2019). However, mathematics anxiety can hinder this success, and early intervention is crucial (Brewster, 2020). The development of strong mathematical knowledge is important for academic and career success (Siregar et al, 2023; Bhasin, 2023), and it is associated with better logical thinking and reasoning (Cresswell & Speelman, 2020). In developing countries, mathematics is crucial for innovation and technological advancement (Pumwa, 2020). Consequently, proficiency in mathematics is essential for learners, impacting their future academic and career opportunities.

Recognizing the importance of quality education, the Philippine government, through the Department of Education (DepEd), has implemented numerous initiatives aimed at improving the educational system. DepEd has issued several orders to enhance the delivery of education, such as DepEd Order No. 21, s. 2019, which focuses on the policy guidelines on the K to 12 Basic Education Program, and DepEd Order No. 31, s. 2020, which provides guidelines on curriculum and learning delivery during the COVID-19 pandemic. These efforts are designed to ensure that learners receive quality education that is responsive to their needs.

Despite these initiatives, mathematics anxiety and self-efficacy remain significant barriers to learning mathematics. Mathematics anxiety can lead to stress and a lack of confidence, severely affecting learners' performance. The Programme for International Student Assessment (PISA) results have highlighted this issue, showing that Filipino learners scored significantly lower in mathematics compared to their international peers, underscoring the need for focused interventions to address these psychological barriers to learning (OECD, 2019).

The gap in mathematics performance is evident in various public schools. Studies such as those by Estonanto and Dio (2019) have shown that high levels of mathematics anxiety and low self-efficacy contribute to the poor performance of senior high school learners in mathematics (Estonanto & Dio, 2019). Another study by Ablian (2022) also highlights similar issues, emphasizing the pervasive nature of these challenges in public secondary schools (Ablian, 2022). These findings are consistent with the PISA results, which indicate a broader national trend of underachievement in mathematics.

Given the national context and specific challenges in Leyte Division, there was a need to conduct this study. Gathering empirical data regarding the learner's mathematics anxiety, self-efficacy, and mathematics performance allows the researcher to provide scientific data for evidence-based practice in the school where the study is conducted. Addressing these factors can lead to more effective teaching-learning process, ultimately improving mathematics outcomes for high school learners.

Research Questions

This research assessed the math anxiety, self-efficacy, and academic performance of Grade 7 learners in learning mathematics at an identified school in Leyte Division for the School Year 2023-2024. Specifically, the study sought to answer the following questions:

1. What is the respondents' level of mathematics anxiety?
2. What is the respondents' level of self-efficacy in learning mathematics?
3. What is the respondents' academic performance?
4. Is there a significant relationship between mathematics anxiety, self-efficacy, and academic performance in mathematics?

Methodology

This study employed a descriptive-correlational design to investigate the relationships between math anxiety, self-efficacy, and academic performance in Mathematics among 87 Grade 7 learners in a high school in Leyte Division during the 2023-2024 school year. Complete enumeration was employed in selecting the respondents. The researchers measured math anxiety and self-efficacy using adapted questionnaires, specifically the Mathematics Anxiety Rating Scale of Alexander and Martray (1989) for math anxiety and a questionnaire from the study of Nicolaidou and Philippou (2003) for self-efficacy. Responses were scored on a 5-point Likert scale, with lower scores indicating more negative attitudes. Academic performance was assessed using first quarter grades. Data collection involved obtaining necessary permissions, administering surveys to respondents, and collecting completed questionnaires on the same day.

Statistical analysis of the data included descriptive measures such as frequency counts, percentages, and weighted means to determine levels of anxiety and self-efficacy. Pearson's r correlation coefficient was used to test the significance of correlations between the variables. The systematic random sampling technique was applied to select learners aged 11 to 13, which is typical for Grade 7 in the K-12 DepEd program.

Results and Discussion

This section presents the results and findings of the study based on the sequence of the sub-problems.

Table 1 presents the respondents' level of Mathematics anxiety. The highest anxiety levels are observed in tasks involving practical, real-world applications such as "Being given a set of numerical problems involving addition to solve on paper" (WM=4.45) and "Reading a cash register receipt after your purchase" (WM=4.31), both categorized as "Very High." This indicates that respondents experience the most anxiety when dealing with immediate, real-life mathematical tasks.

Table 1. *Level of Math Anxiety of the Respondents*

S/N	*Indicators*	*WM*	*Verbal Description*
1	Studying for a math test.	3.66	High
2	Taking math section of the college entrance exam.	3.33	Moderate
3	Taking an exam (quiz) in a math subject.	3.87	High
4	Taking an exam (final) in a math subject.	4.19	High
5	Picking up math textbook to begin working on a homework assignment.	3.23	Moderate
6	Being given homework assignments of many difficult problems that are due the next class meeting.	2.34	Low
7	Thinking about an upcoming math test 1 week before.	3.53	High
8	Thinking about an upcoming math test 1 day before.	3.06	Moderate
9	Thinking about an upcoming math test 1 hour before.	2.59	Low
10	Realizing you have to take a certain number of math classes to fulfill requirements.	3.36	Moderate
11	Picking up math textbook to begin a difficult reading assignment.	2.67	Moderate
12	Receiving your final math grade.	3.83	High
13	Opening a math or stat book and seeing a page full of problems.	2.97	Moderate
14	Getting ready to study for a math test.	3.34	Moderate
15	Being given a "pop" quiz in a math class.	2.84	Moderate
16	Reading a cash register receipt after your purchase.	4.31	Very High
17	Being given a set of numerical problems involving addition to solve on paper.	4.45	Very High
18	Being given a set of subtraction problems to solve.	3.87	High
19	Being given a set of multiplication problems to solve.	3.51	High
20	Being given a set of division problems to solve.	3.05	Moderate
21	Buying a math textbook.	2.78	Moderate
22	Watching a teacher work on an algebraic equation on the blackboard.	4.02	High
23	Enrolling for a math class.	3.29	Moderate
24	Listening to another student explain a math formula.	3.35	Moderate
25	Walking into a math class.	3.35	Moderate
	Aggregate Weighted Mean	3.39	Moderate

Legend: 4.21-5.00-Very High; 3.41-4.20-High; 2.61-3.40-Moderate; 1.81-2.60-Low; 1.00-1.80-Very Low

Conversely, the lowest anxiety levels are associated with "Being given homework assignments of many difficult problems that are due the next class meeting" (WM=2.34) and "Thinking about an upcoming math test 1 hour before" (WM=2.59), both categorized as "Low," suggesting that anticipatory anxiety and structured academic tasks provoke less anxiety than real-time problem-solving.

These findings align with recent literature, such as the study by Pinugu et al (2023), which highlights that mathematics anxiety is significantly influenced by practical applications and real-life scenarios. Their research demonstrated that math anxiety considerably impacts learners' performance and engagement, particularly in contexts where the mathematical tasks are perceived as immediately relevant or high stakes. The overall moderate aggregate weighted mean (WM=3.39) indicates a general prevalence of math anxiety among respondents, emphasizing the need for educational strategies that reduce anxiety by connecting theoretical learning with practical applications and offering support in high-anxiety situations.

Level of Self-Efficacy in Learning Mathematics

Table 2 illustrates the self-efficacy levels among respondents in learning mathematics. The overall aggregate weighted mean (WM) is 2.47, indicating a generally low self-efficacy. The individual indicators further highlight this trend, with the lowest levels of self-efficacy seen in items such as "Compared to other learners, I am a smart student in Mathematics" (WM=1.90) and "I can usually solve any mathematical problem" (WM=2.07). These findings suggest that learners generally do not perceive themselves as highly capable or strong in mathematics.

Table 2. *Level of Self-efficacy of the Respondents*

S/N	*Indicators*	*WM*	*Verbal Description*
1	I am one of the best learners in Mathematics.	2.22	Low
2	I believe that I have a lot of strengths in Mathematics.	2.33	Low
3	Compared to other learners, I am a smart student in Mathematics.	1.90	Low
4	Mathematics is one of my strengths.	2.47	Low
5	I usually can help my classmates, when they ask me for help in problem-solving.	3.23	Moderate
6	I can usually solve any mathematical problem.	2.07	Low
7	I feel sure about myself in solving Mathematical problems.	2.57	Low
8	When I start answering a mathematical question, I usually feel that I would manage to give a solution.	3.10	Moderate
9	I can easily understand Mathematical problems.	2.27	Low
10	I am capable of making good grades in Math.	2.53	Low
	Aggregate Weighted Mean	2.47	Low

Legend: 4.21-5.00-Very High; 3.41-4.20-High; 2.61-3.40-Moderate; 1.81-2.60-Low; 1.00-1.80-Very Low

On the other hand, moderate self-efficacy levels are reported in scenarios where learners engage in peer interactions or start solving problems, such as "I usually can help my classmates, when they ask me for help in problem-solving" (WM=3.23) and "When I start answering a mathematical question, I usually feel that I would manage to give a solution" (WM=3.10). These moderate scores indicate that while learners may doubt their overall mathematical abilities, they exhibit some confidence in collaborative and problem-initiating contexts.

The low overall self-efficacy in mathematics among the respondents indicates a potential barrier to their academic performance and engagement in the subject. This aligns with the study by Dagdag et al. (2020), which found that self-efficacy in problem-solving is crucial for academic achievement in mathematics. Their research highlighted that verbal persuasions and somatic responses significantly contribute to learners' problem-solving efficacy.

Similarly, Salazar and Basierto (2021) identified a significant relationship between the classroom environment and learners' self-efficacy, emphasizing that supportive teacher-student interactions can enhance learners' confidence in their mathematical abilities. These findings suggest that interventions aimed at improving learners' self-efficacy, such as providing positive feedback, setting achievable goals, and fostering a supportive learning environment, could be beneficial in enhancing their mathematical performance and reducing anxiety.

Level of Academic Performance in Mathematics

Table 3 provides an overview of the respondents' academic performance in mathematics, categorized into five levels: Advanced, Proficient, Advancing Proficiency, Developing, and Beginning. The data reveals that 17.44% of the respondents are performing at an Advanced level (90-100), while 18.60% are at the Proficient level (85-89). The largest group, 34.88%, falls into the Advancing Proficiency category (80-84), indicating a solid understanding of mathematical concepts.

Moreover, 22.09% of the respondents are in the Developing category (75-79), and 6.98% are in the Beginning category, struggling with the subject (below 75). The mean score of 82.20, with a standard deviation of 7.06, suggests that the average performance is within the Advancing Proficiency range, with a moderate spread around the mean. This distribution indicates that while a significant majority of learners demonstrate proficiency or better in mathematics, there is still a need for contextualized support to help those in the Developing and Beginning categories improve their skills.

The result suggests that a significant portion of the respondents, approximately 71%, are performing at or above the "Advancing Proficiency" level (80-100). This is a positive indicator, as the majority of learners demonstrate a solid understanding of mathematical concepts. The highest concentration of learners (34.88%) falls within the "Advancing Proficiency" range, suggesting that while they are not at the top performance level, they have a strong grasp of the subject matter. Conversely, a smaller percentage of learners (6.98%)

are in the "Beginning" category, indicating substantial difficulties with mathematics.

Table 3. *Level of Mathematics Performance of the Respondents*

Level	*Numerical Range*	*f*	*%*
Advanced	90-100	15	17.44
Proficient	85-89	16	18.60
Advancing Proficiency	80-84	30	34.88
Developing	75-79	19	22.09
Beginning	Below 75	6	6.98
Total		86	100.00
Mean		82.20	
St. Dev.		7.06	

The finding aligns with the study of Etcuban et al. (2019), which identified that learners' attitudes towards mathematics and their study habits significantly influence their academic performance (Etcuban et al., 2019). Improving these factors through targeted interventions, such as positive reinforcement and improved study strategies, could help elevate learners from the "Developing" and "Beginning" categories to higher performance levels.

Correlation between Mathematics Anxiety and Academic Performance

Table 4 provides the results of the correlational analysis between mathematics anxiety and academic performance among respondents. The correlation coefficient (r-value) is 0.141, indicating a negligible positive correlation between math anxiety and academic performance. The p-value is 0.194, which is greater than the significance threshold of 0.05. Consequently, we do not reject the null hypothesis (Ho), suggesting that the correlation is not statistically significant.

Table 4. *Test of Correlation between Math Anxiety and Academic Performance*

Variables	*r*	*Strength of Correlation*	*p - value*	*Result*	*Decision on Ho*
Math Anxiety and Academic Performance	0.141	Negligible Positive	0.194	Not Significant	Failed to Reject

**significant at p<0.05 (two-tailed)*

The analysis reveals no significant relationship between mathematics anxiety and academic performance among the respondents. The negligible positive correlation (r=0.141) implies a very weak association where increased anxiety might slightly improve performance, but this relationship is statistically insignificant. This finding aligns with the study by Estonanto (2018), which also found that while math anxiety exists among learners, its direct impact on performance in pre-calculus was not substantial.

Furthermore, research by Macabodbod (2023) highlighted that while there is a significant negative correlation between math anxiety and achievement, other factors such as student-teacher rapport also play a crucial role in mitigating the impact of anxiety on performance. Overall, the current study suggests that interventions focused solely on reducing math anxiety may not significantly enhance academic performance unless they also address other educational and psychological factors.

Correlation between Self-Efficacy and Academic Performance

Table 5 provides the results of the correlational analysis between self-efficacy and academic performance among respondents.

Table 5. *Test of Correlation between Self-Efficacy and Academic Performance*

Variables	*r*	*Correlation strength*	*p-value*	*Result*	*Decision on Ho*
Self-efficacy and Academic Performance	-0.127	Negligible Negative	0.246	Not Significant	Failed to Reject

**significant at p<0.05 (two-tailed)*

The correlation coefficient (r) is -0.127, indicating a negligible negative correlation between self-efficacy and academic performance. The p-value is 0.246, which is greater than the significance threshold of 0.05. Consequently, the null hypothesis (Ho) is not rejected, suggesting that the correlation is not statistically significant. The analysis reveals no significant relationship between self-efficacy and academic performance among the respondents. The negligible negative correlation (r=−0.127r = -0.127r=−0.127) suggests that higher self-efficacy is very weakly associated with lower academic performance, but this relationship is statistically insignificant.

This finding contrasts with some studies that have found a positive relationship between self-efficacy and academic performance. For instance, Callaman and Itaas (2020) concluded that self-efficacy is a significant predictor of learners' mathematical achievement, emphasizing the importance of confidence in academic success. However, the results in Table 5 suggest that for this specific sample, self-efficacy does not significantly relate with academic performance. This could be due to various moderating factors such as teaching methods, classroom environment, or individual differences in coping strategies.

Conclusions

The study revealed a moderate math anxiety, low self-efficacy, and varying academic performance respondents, which leads to several implications. The moderate math anxiety observed, especially in practical tasks, necessitates integrating theoretical learning with real-world applications to mitigate anxiety and improve engagement. The low self-efficacy levels highlight the need for interventions that build confidence through positive reinforcement, achievable goal-setting, and supportive classroom environments. Although many

learners performed at or above the "Advancing Proficiency" level, the findings stress the importance of tailored support for those in lower performance categories to bridge gaps in understanding. The lack of significant correlation between math anxiety, self-efficacy, and academic performance suggests that enhancing teaching quality and the classroom environment may be more effective in improving academic outcomes.

Enhance self-efficacy through contextualized interventions such as workshops and mentorship programs.

Improve teaching strategies and create a supportive classroom environment with diverse instructional methods.

Regularly monitor learners' self-efficacy and academic performance to provide personalized support and resources.

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