Math Anxiety and Academic Math Performance: A Gender-Based Comparative Analysis

Joven T. Ambilong

Teacher II, Kananga National High School Kananga, Leyte

ABSTRACT

This study examined the relationship between math anxiety and academic math performance among grade 11 students at Kananga National High School – Senior High School, with gender as a comparative variable. A quantitative correlational-comparative research design was employed. Data were obtained from 231 Grade 11 students during the School Year 2025 – 2026 using a validated math anxiety questionnaire and official mathematics grades. Descriptive and inferential statistical techniques, including frequency percentage, weighted mean, Pearson product-moment correlation, and independent samples t-test were applied at the 0.05 level of significance. Results revealed that students exhibited a moderate level of math anxiety and a generally satisfactory level of academic math performance. Correlation analysis indicated a statistically significant moderate negative relationship between math anxiety and academic performance, suggesting that high anxiety is associated with decreased performance in mathematics. Furthermore, significant gender differences were observed. Female students demonstrated significantly higher levels of math anxiety, whereas male students obtained significantly higher academic math performance. The findings affirm that math anxiety is a critical affective factor influencing mathematics performance and that gender plays a significant role in shaping students' emotional experiences and academic outcomes. The study recommends the implementation of anxiety-reduction interventions, gender-responsive instructional strategies, and supportive learning environments to enhance students' confidence and academic performance in mathematics.

Keywords: academic math performance, gender differences, math anxiety

INTRODUCTION

Mathematics is widely recognized as a fundamental component of modern education and an essential skill for participation in higher education, employment, and daily decision-making. According to the Organisation for Economic Co-operation and Development (OECD, 2023), mathematical literacy enables individuals to analyze information, solve problems, and adapt to the increasing demands of globally competitive society. Despite its importance, many students struggle to achieve proficiency in mathematics, not solely due to cognitive difficulties but also because of emotional factors that interfere with learning.

One of the most prominent emotional barriers affecting mathematics learning is math anxiety. Math anxiety refers to feeling of tension, apprehension, or fear that interfere with the manipulation of numbers and the solving of mathematical problems in both academic and evaluative contexts (Ashcraft & Kirk, 2001). Extensive research has demonstrated that students who experience high levels of math anxiety tend to avoid math-related tasks, display reduced self-confidence, and exhibit lower persistence when confronted with challenging mathematical problems (Ma. & Xu, 2004). Recent meta-analytic evidence further confirms that math anxiety is consistently and negatively associated with mathematics achievement across age groups and educational setting (Barroso et al., 2020).

From a cognitive perspective, math anxiety has been shown to disrupt essential mental processes required for effective mathematical performance. According to Eysenck and Calvo's Processing Efficiency Theory, anxiety consumes working-memory resources, limiting students' capacity to focus and solve complex problems. Empirical studies support this explanation, demonstrating that persistent math anxiety interferes with attention,

cognitive flexibility, and working memory capacity, ultimately leading to poorer academic outcomes (Carey et al., 2016). These findings suggest that anxiety-related cognitive interference plays a crucial role in explaining why some students underperform in mathematics despite having sufficient ability.

Gender differences in math anxiety and academic performance have also been documented in previous studies. Geary et al. (2019) found that female students tend to report higher levels of math-related anxiety than their male counterparts, particularly in test and evaluation settings. Eccles' expectancy-value theory explains that socialization processes, classroom experiences, and societal expectations shape students' beliefs and emotional responses toward mathematics, often placing female students at greater risk of developing math anxiety (Eccles, 2011). More recent studies further suggest that heightened anxiety may partially account for observed gender differences in mathematics achievement (Van Mier et al., 2019).

In the Philippine context, the issue of math anxiety is further reflected in students' performance in national and international assessments. Results from the Trends in International Mathematics and Science Study (TIMSS) revealed that only a small proportion of Filipino students achieved high proficiency level in mathematics (Mullis et al., 2020). Similarly, findings from the Programme for International Student Assessment (PISA) indicated that a large percentage of Filipino senior high school -aged students failed to reach the minimum level of mathematics proficiency compared to the OECD average (OECD, 2023). These results highlight the need to examine not only instructional practices but also emotional factors such as anxiety that may hinder students' academic progress.

Preliminary observations at Kananga National High School – Senior High School suggest that many Grade 11 students experience varying levels of stress and anxiety when engaging in mathematics. Teachers have noted differences in students' confidence, willingness to participate, and academic performance during math-related activities. Anecdotal evidence also suggests that these experiences may differ between male and female students, making the school a suitable setting for investigating the interaction between math anxiety, academic performance, and gender.

Despite extensive international research on math anxiety, there remains a shortage of localized studies that examine how this issue affects senior high school students in Philippine public schools. Contextual factors such as cultural expectations, school environment, and gender roles may influence how math anxiety develops and impacts academic performance.

This study aims to examine the relationship between math anxiety and academic math performance among Grade 11 students at Kananga National High School – Senior High School and compare the findings based on gender. Specifically, the study sought to answer the following questions.

1. What is the demographic profile of Grade 11 students at Kananga National High School – Senior High School?

2. What is the level of math anxiety among Grade 11 students?

3. What is the academic performance in mathematics of Grade 11 students, based on their mathematics grades?

4. Is there a significant relationship between math anxiety and academic math performance?

5. Is there a significant difference in math anxiety levels between male and female Grade 11 students?

6. Is there a significant difference in academic math performance between male and female Grade 11 students?

METHODS

Research design

The study utilized a quantitative correlational-comparative research design. The correlational component was intended to determine whether a significant relationship existed between students' anxiety and their academic

math performance. This design was suitable because it allowed the researcher to measure the degree and direction of association between naturally occurring variables without manipulating them.

The comparative component of the design was conducted to determine the significant differences existed in the levels of math anxiety and academic math performance between male and female students. Since the study examined gender as a moderating variable, comparative analysis provided a structured method of examining whether males and females differ significantly in their experiences and academic outcomes.

Research Locale

The study was conducted at Kananga National High School – Senior High School, a public educational institution located in Kananga, Leyte. The school implemented various academic and technical-vocational strands under the K-12 curriculum, including Accountancy, Business, and Management (ABM), General Academic Strand (GAS), Humanities and Social Sciences (HUMSS), and Technical - Vocational – Livelihood (TVL).

Kananga National High School – Senior High School was purposively selected as the research locale due to several pertinent considerations. First, preliminary classroom observations reported by mathematics teachers revealed a substantial occurrence of math anxiety-related behaviors among Grade 11 students, including task avoidance, reduced self-confidence, and heightened apprehension toward mathematics-related activities. Second, anecdotal evidence indicated that these anxiety-related experiences varied between male and female students. Collectively, these conditions established the school as a suitable and relevant setting for examining the relationship between math anxiety, academic math performance, and gender differences.

The school's availability of multiple mathematics subjects such as general mathematics and statistics and probability allowed for a more comprehensive assessment of academic math performance.

Research Respondents

The target population of this study consisted of all Grade 11 students enrolled in mathematics subjects at Kananga National High School – Senior High School during the School Year 2025 – 2026. The total population size was 328 students, comprising 165 male students and 163 female students. Both gender groups were included as respondents to facilitate the gender-based comparative analysis that will be conducted.

Sampling Procedure

The study employed stratified random sampling to select the participants. The population was divided into two mutually exclusive strata: (1) male Grade 11 students; and (2) female Grade 11 students. Simple random sampling was then applied to select respondents from each stratum, ensuring that every student in each group had an equal chance of being selected. This sampling method ensured proportional representation of both gender groups, minimizing sampling bias and enhancing generalizability of findings to the target population.

The sample size was determined using Raosoft sample size calculator, which was selected due to its user-friendly interface and ability to quickly provide sample sizes based on population size, confidence level, and margin of error. The parameters were set at a 95% confidence level and a 0.05 margin of error. The population under study comprised 165 male students and 163 female students.

Based on the computation, the final sample size consisted of 231 students, including 116 male students and 115 female students. This sample size provided sufficient statistical power to conduct both correlational and comparative analysis effectively.

Research Instruments

A standard 5-point Likert-scale math questionnaire was used to measure the level of math anxiety among respondents. The instrument was adapted from Jolejole-Caube et al. (2019), a validated tool for local high school students, and consisted of 16 items. Responses were scored as follows: 1 = Not Anxious at all, 2 = Not Anxious,

3 = Slightly Anxious, 4 = Anxious, 5 = Very Anxious. Higher total scores indicated higher levels of math anxiety. The Math Anxiety Questionnaire yielded a Cronbach's alpha coefficient of 0.87, indicating excellent internal consistency.

Academic math performance referred to the respondents' official mathematics grades for the first grading period of School Year 2025 – 2026. These grades were obtained from the school registrar and subject teachers upon approval. The grades were expressed in percentage form (0-100) and were classified as Outstanding (90-100), Very Satisfactory (85-89), Satisfactory (80-84), Fairly Satisfactory (75-79), and Did Not Meet Expectations (below 75). This measure reflected students' actual performance in mathematics.

Data Gathering Procedures

Prior to data collection, formal permission to conduct the study was obtained from the school principal of Kananga National High School – Senior High School. Ethical considerations were strictly observed throughout the research process. Informed consent was secured from all participating students and their parents or guardians. Participation was voluntarily, confidentiality was assured, and respondents were informed of their right to withdraw at any time without penalty.

The Math Anxiety Questionnaire was distributed during a scheduled math class, with the researcher present to provide clear instructions and address any questions. Respondents were given 15 – 20 minutes to complete the questionnaire. Official math grades were obtained from the school registrar two weeks after questionnaire administration to ensure grades were finalized and to maintain respondent anonymity.

All collected data were coded using identifiers to protect respondent anonymity and were checked for completeness and accuracy prior to statistical analysis.

Statistical Treatment of Data

Data were analyzed using appropriate statistical tools. Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to describe students' demographic profile, levels of math anxiety, and academic math performance. Pearson product-moment correlation analysis was employed to determine the relationship between math anxiety and academic math performance. Independent samples t-test were used to examine significant differences in math anxiety levels and academic performance between male and female students. All statistical tests were conducted at a 0.05 level of significance.

Results and Discussions

Table 1. Demographic Profile of the Respondents According to Gender

Gender	Frequency (f)	Percentage (%)
Male	116	50.22%
Female	115	49.78%
Total	231	100.00

Table 1 shows that the respondents were composed of 116 male students (50.22%) and 115 female students (49.78%%). This balanced representation ensured validity of gender-based comparisons conducted in the study. Similar studies examining gender differences in math anxiety emphasized the importance of proportional gender representation to avoid biased representations (Jolejole-Caube et al., 2019).

Table 2. Level of Math Anxiety of Grade 11 Students

Mean Range	Descriptive Level	Frequency (f)	Percentage (%)
1.00 – 1.80	Very Low	46	19.91%
1.81 – 2.60	Low	66	28.57%
2.61 – 3.40	Moderate	73	31.60%
3.41 – 4.20	High	31	13.42%
4.21 – 5.00	Very High	15	6.49%
Mean Anxiety Score = 2.59 (Moderate)		231	100.00%

Table 2 presents the distribution of math anxiety levels among the Grade 11 students. The results indicate the largest proportion of respondents (31.60%) experienced a moderate level of math anxiety, followed by those with low anxiety (28.57%). Smaller proportions reported high (13.42%) and very high (6.49%) levels of math anxiety, while 19.91% demonstrated very low anxiety. The overall mean anxiety score of 2.59 indicates a moderate level of math anxiety among Grade 11 students.

This finding aligns with international studies showing that senior high school students commonly experience moderate math anxiety due to increased academic demands, evaluative pressure, and higher cognitive expectations in mathematics subjects (Barroso et al., 2020). According to the Processing Efficiency Theory, anxiety consumes attentional and working-memory resources, thereby reducing the efficiency with which students process mathematical information (Eysenck & Calvo, 1992). As a result, even students with adequate mathematical ability may experience difficulty when anxiety levels are elevated.

Table 3. Academic Math Performance of Grade 11 Students

Grade Range	Descriptive Rating	Frequency (f)	Percentage (%)
90 - 100	Outstanding	72	31.17%
85 - 89	Very Satisfactory	24	10.39%
80 - 84	Satisfactory	64	27.71%
75 - 79	Fairly Satisfactory	71	30.74%
Below 75	Did Not Meet Expectations	0	0.00%
Mean Grade = 84.35 (Satisfactory)		231	100.00%

Table 3 presents the academic math performance of the Grade 11 students in mathematics based on Department of Education grading classification. The results show that students' performance ranges from fairly satisfactory to outstanding. The largest proportion of the students obtained grades classified as outstanding (31.17%), followed closely by those in fairly satisfactory category (30.74%). Meanwhile, 27.71% of the students achieved satisfactory performance, and 10.39% attained very satisfactory ratings. Notably, no students fell below the minimum academic expectation. The computed mean grade of 84.35 corresponds to a Satisfactory level of academic performance.

These results support previous findings that students may still perform at acceptable levels despite experiencing anxiety; however, anxiety may limit their ability to achieve optimal performance (Ashcraft & Kirk, 2001).

Research has also shown that emotional factors, such as anxiety and academic emotions, play a crucial role in explaining differences in achievement beyond cognitive ability alone (Pekrun et al., 2017).

Table 4. Pearson Correlation Between Math Anxiety and Academic Math Performance

Variables	R	Strength & Direction	p-value	Interpretation
Math Anxiety and Academic Math performance	-0.668	Moderate Negative Correlation	<.001	Significant

Table 4 presents the results of the Pearson correlation analysis between math anxiety and academic math performance. The computed correlation coefficient ($r = -0.668$) indicates a moderate and statistically significant relationship between the two variables. Since the p-value is less than the 0.05 level of significance, the null hypothesis is rejected. This finding suggests that higher levels of math anxiety are associated with lower academic performance in mathematics.

The result strongly supports existing literature demonstrating an inverse relationship between math anxiety and mathematics achievement (Zhang et al., 2019). According to Processing Efficiency Theory, anxiety consumes cognitive resources necessary for mathematical reasoning, leading to reduced performance (Eysenck & Calvo, 1992).

Table 5. Independent Samples t-Test on Math Anxiety Levels by Gender

Gender	Mean (M)	SD	t	p-value	Decision	Interpretation
Male	2.75	0.82	-3.95	< .001	Reject H0	Significant
Female	3.15	0.73				

Table 5 shows that there is a statistically significant difference in math anxiety levels between male and female Grade 11 students, t = -3.95, p = <.001 at the 5% level of significance. Female students obtained a higher mean math anxiety score (M = 3.15, SD = 0.73) than male students (M = 2.75, SD = 0.82).

Although this finding is consistent with prior research indicating higher levels of math anxiety among female students (Geary et al., 2019; Szczygiel, 2020), it is important recognize the substantial variability that exists within each gender group. This variability indicates that gender alone does not determine students' experiences of math anxiety. Rather, evidence suggests that math anxiety is more strongly influenced by psychosocial factors, such as self-efficacy, classroom climate, instructional practices, and societal expectations than by inherent gender-based differences in mathematical ability (Eccles, 2011; Pekrun et al., 2019).

Table 6. Independent Sample t-Test on Academic Math Performance by Gender

Gender	Mean Grade (M)	SD	t	p-value	Decision	Interpretation
Male	86.88	6.53	6.55	<.001	Reject H0	Significant
Female	81.63	5.64				

Table 6 reveals a statistically significant difference in academic math performance between male and female students. Male students obtained a higher mean mathematics grade (M = 86.88, SD = 6.53) compared to female students (M = 81.63, SD = 5.64). Since the p-value is <.001, which is less than the 0.05 level of significance, the null hypothesis is rejected.

This finding is consistent with studies indicating that heightened anxiety among female students may partially explain lower academic performance in mathematics (Van Mier et al., 2019). While research suggests that gender

difference in mathematical ability are generally small, emotional factors such as anxiety and self-efficacy have been found to exert a stronger influence on performance outcomes (Pekrun et al. 2019).

Overall, the findings of the study indicate that Grade 11 students at Kananga National High School – Senior High School generally experience moderate levels of math anxiety and demonstrate satisfactory to outstanding academic performance in mathematics. A significant negative relationship exists between math anxiety and academic math performance, confirming that increased anxiety is associated with decreased achievement. Moreover, significant gender differences were found both in math anxiety levels and academic performance, with female students experiencing higher anxiety and male students achieving higher mathematics grades.

CONCLUSIONS

This study concludes that Grade 11 students at Kananga National High School – Senior High School experience a moderate level of math anxiety, while their academic performance is generally satisfactory. This indicates that although students are able to perform reasonably well in mathematics, anxiety concern that may hinder their full academic potential.

The study further establishes that math anxiety is significantly and negatively related to academic math performance. Students with higher levels of math anxiety tend to exhibit lower academic performance in mathematics, confirming that math anxiety is a critical psychological factor that adversely affects students' learning and performance.

In terms of gender differences, the findings indicate that female students experience significantly higher levels of math anxiety than male students. This suggests that gender-related factors, such as self-confidence, emotional responses, and social expectations may influence students' anxiety levels toward mathematics.

Additionally, the study reveals a significant difference in academic math performance between male and female students, while male students demonstrating higher academic performance in mathematics. This result implies that heightened anxiety among female students may contribute to their relatively lower performance, reinforcing the role of emotional and psychological factors in academic outcomes.

Overall, the study concludes that math anxiety plays a significant role in influencing academic math performance, and gender serves as an important factor affecting both anxiety levels and academic performance.

Limitations of the Study

Despite the significant findings, the study has several limitations that should be considered when interpreting the results. First, the study relied solely on quantitative self-report data to measure math anxiety. The absence of qualitative data limits a deeper understanding of students' lived experiences, emotional responses, and contextual factors that may influence anxiety and performance in mathematics.

Second, the study did not account for potential strand-based differences among students enrolled in various academic and technical-vocational tracks. Differences in curriculum focus, instructional demands, and assessment practices across strands may influence both math anxiety and academic performance.

Third, the cross-sectional nature of the research design restricts causal interpretation. While a significant relationship between math anxiety and academic math performance was established, the design does not all for conclusions regarding directionality or long-term effects are therefore necessary to examine causal pathways and developmental trends.

RECOMMENDATIONS

Based on the findings, schools should implement structured interventions aimed at reducing math anxiety, particularly among students exhibiting higher anxiety levels. Mathematics teachers are encouraged to adopt learner-centered and gender-responsive instructional strategies that promote confidence, reduce fear of failure, and enhance active participation in mathematics learning.

Future research may extents the present findings by employing mixed-methods designs that integrate quantitative measures with qualitative interviews or focus group discussions to capture students' nuanced experiences of math anxiety. Additionally, intervention-based or experimental studies are recommended to examine the effectiveness of anxiety-reduction programs, such as cognitive-behavioral strategies mindfulness-based approaches, or gender-responsive instructional practices. Longitudinal studies may also be conducted to explore how math anxiety and academic performance evolve over time, thereby moving beyond correlational findings toward more explanatory and applied insights.

REFERENCES

1. Ashcraft, M. H., & Kirk, E.P. (2001). The relationships among working memory, math anxiety, and performance. Journal of Experimental Psychology: General, 130 (2), 224 – 237.https://doi.org/10.1037/0096-3445.130.2.224
2. Bandura, A. (1997). Self-efficacy: The exercise of control. New York, NY: W. H. Freeman.
3. Barroso, C., Ganley, C. M., McGraw, A. L., Geer, E. A., Hart, S. A., & Daucort, M.C. (2020). A meta-analysis of the relation between math anxiety and math achievement. Psychological Bulletin, 146(2), 134 – 168. https://doi.org/10.1037/bul0000216
4. Bernardo, A.B. I. (2008). Individual and social dimensions of Filipino students' mathematics achievement. Asia Pacific Education Review, 9(1), 1-12. https://doi.org/10.1007/BF03024918
5. Carey, E., Hill, F., Devine, A., & Szucs., D. (2016). The chicken or the eggs? The direction of the relationship between math anxiety and math achievement. Frontiers in Pscychology, 6, 1987.https://doi.org/10.3389/fpsyg.2015.01987
6. Caviola, S., Carey, E., Mammarella, I. C., & Szucs, D. (2021). Stress, time pressure, and math performance: The role of math anxiety. Learning and Individual Differences, 88, 102031.https://doi.org/10.1016/j.lindif.2021.102031.
7. Department of Education. (2016). K to 12 curriculum guides: Mathematics. Pasig City, Philippines: Author.
8. Eccles, J. S. (2011). Gendered educational and occupational choices: Applying the Eccles et al. model of achievement-related choices. International Journal of Behavioral Development, 35(3), 195 – 201.https://doi.org/10.11777/0165025411398185
9. Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. Cognition and Emotion, 6(6), 409 – 434. http://doi.org/10.1080/02699939208409969
10. Foley, A. E., Herts, J. B., Borgonovi, F., Guerriero, S., Levine, S. C., & Beilock, S. L. (2017). The math anxiety–performance link: A global phenomenon. Current Directions in Psychological Science, 26(1), 52–58.https://doi.org/10.1177/0963721416672463
11. Geary, D. C., Hoard, M. K., Nugent, L., & Bailey, D. H. (2019). Mathematical cognition and learning difficulties. Journal of Learning Disabilities, 52(2), 101–113.
12. Hembree, R. (1990). The nature, effects, and relief of mathematics anxiety. Journal for Research in Mathematics Education, 21(1), 33–46.https://doi.org/10.2307/749455
13. Llego, M. A. (2018). Mathematics anxiety and achievement of senior high school students. DepEd Research Journal, 4(1), 55–69.
14. Ma, X., & Xu, J. (2004). The causal ordering of mathematics anxiety and mathematics achievement. Journal of Adolescence, 27(2), 165–179.https://doi.org/10.1016/j.adolescence.2003.11.003
15. Mullis, I. V. S., Martin, M. O., Foy, P., Kelly, D. L., & Fishbein, B. (2020). TIMSS 2019 international results in mathematics and science. Boston, MA: TIMSS & PIRLS International Study Center.
16. Organisation for Economic Co-operation and Development. (2023). PISA 2022 results (Volume I): The state of learning and equity in education. Paris, France: OECD Publishing.https://doi.org/10.1787/53f23881-en
17. Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., & Goetz, T. (2019). Achievement emotions and academic performance. Journal of Educational Psychology, 111(3), 440–457. https://doi.org/10.1037/edu0000304
18. Ramirez, G. (2005). Math anxiety and cognitive interference. Journal of Experimental Psychology: General, 134(2), 218–234. https://doi.org/10.1037/a0032014

19. Republic of the Philippines. (2013). Republic Act No. 10533: Enhanced Basic Education Act of 2013. Manila, Philippines: Author.

20. Szczygiel, M. (2020). Gender differences in general anxiety and math anxiety. Personality and Individual Differences, 162, 110031.https://doi.org/10.3389/fpsyg.2019.00114

21. Van Mier, H. I., Schleepen, T. M., & Van den Berg, F. C. (2019). Gender differences in math anxiety and arithmetic performance. Frontiers in Psychology, 10, 1–12.

22. Yazon, A. D., Ang-Manaig, K., Tesoro, J. F., & Buenvinida, L. (2019). Attitude and anxiety toward mathematics of Filipino students. International Journal of Educational Research and Innovation, 11, 210–223.

23. Zabala, R. M., & Calaguas, G. M. (2017). Mathematics self-efficacy, anxiety, and performance of Filipino students. Philippine Journal of Counseling Psychology, 19(1), 23–39.

24. Zhang, J., Zhao, N., & Kong, Q. (2019). The relationship between math anxiety and math performance: A meta-analytic review. Educational Psychology Review, 31(4), 1–28. https://doi.org/10.1007/s10648-019-09493-2