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Mathematics Anxiety and Level of Motivation in Relation to the Academic Performance of Public Senior High School Students

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ABSTRACT

Many Filipino senior high school students fear mathematics, and this fear may undermine their performance in a subject that shapes their college and career options. This study examined mathematics anxiety and motivation levels among public senior high school students in relation to their academic performance. Using a descriptive-correlational design, it surveyed 109 Grade 11 and 12 students of General Santos City National High School, selected through stratified random sampling, in School Year 2025–2026. A 20-item anxiety questionnaire adapted from the Abbreviated Math Anxiety Scale and a 15-item motivation questionnaire adapted from the Academic Motivation Scale were pilot-tested (α = .78 to .85), and first- and second-quarter mathematics grades were taken from school records. Results showed High anxiety in all four dimensions, led by emotional and cognitive anxiety (*M* = 3.23 each). Nervousness when solving problems in front of the class (3.40), a faster heartbeat before examinations (3.35), and difficulty recalling formulas during tests (3.30) were Very High. Extrinsic motivation was Very High (*M* = 3.30), driven mainly by grades and careers, while intrinsic motivation was High (*M* = 3.23) and amotivation was Fair (*M* = 2.28). Performance was Satisfactory, with mean grades rising from 83.45 to 84.20. Anxiety and motivation were significantly related to age, sex, grade level, strand, and family income, and performance to sex, grade level, and strand. Anxiety correlated moderately and negatively with performance ($r = -.42$, $p = .001$), and motivation correlated moderately and positively ($r = .38$, $p = .002$). Anxiety concentrated in evaluative situations, and external motivation appears to have sustained students' effort. A mental health plan addressing stress, confidence, relevance, and family support is proposed.

Introduction

For senior high school learners, performance in mathematics shapes more than a report card. It determines eligibility for college programs, confidence in pursuing technical and scientific careers, and readiness for the quantitative demands of work. Yet in many Philippine classrooms, mathematics remains the subject students fear most. National and international assessments continue to place Filipino learners below expected proficiency, and teachers describe students who freeze during recitations, delay assignments, and stop trying when a problem becomes complex.

Mathematics anxiety is one explanation for this pattern. It is associated with weaker confidence and motivation and with lower achievement in STEM fields (Gunderson et al., 2023), and it has been tied to declining test scores and fewer enrollments in advanced courses (Rachman et

al., 2023). Anxiety, however, does not operate alone. Motivation can either intensify or soften its effects on performance, yet most local studies have treated anxiety as a single, isolated variable (Colinares & Ucang, 2025; Ablian & Parangat, 2021). Teachers at General Santos City National High School have noticed recurring signs of mathematics anxiety among senior high school students, but no study in that setting has examined how anxiety and motivation together relate to students' performance.

This study investigated the mathematics anxiety and level of motivation of senior high school students at General Santos City National High School in relation to their academic performance in mathematics during School Year 2025–2026. It described the students' profile; measured anxiety in its emotional, physiological, cognitive, and behavioral dimensions and motivation in its intrinsic, extrinsic, and amotivation dimensions at the level of individual indicators; described first- and second-quarter mathematics grades; and tested whether the profile, anxiety, and motivation were significantly related to performance. The results were used to propose a mental health plan for the school.

Literature Review

Mathematics anxiety refers to feelings of tension, fear, and apprehension that arise when individuals deal with numbers or solve mathematical problems, and that interfere with their performance (Suren, 2020; Ashcraft, 2002). It is now understood as a multidimensional experience rather than a single reaction.

The emotional component includes fear, nervousness, helplessness, and frustration, which reduce interest and engagement (Baas, 2020; Ramirez et al., 2025). How students interpret their own anxious feelings influences whether these emotions escalate (Garcia, 2023), and emotion regulation strategies such as reappraisal are associated with lower anxiety and better scores (Cohen et al., 2021). The physiological component appears as a faster heartbeat, sweating, tension, and stomach discomfort (Luttenberger et al., 2018; Lievore et al., 2024). These bodily reactions are not trivial: they draw on the attentional resources required for problem-solving (Esposito et al., 2025), and anticipating a mathematics task can activate neural regions associated with threat (Marakshina et al., 2025). The cognitive component consists of worry and intrusive thoughts that take up working memory (Demedts et al., 2022). Working memory partly mediates the relation between anxiety and performance (Finell et al., 2022), and anxious learners update numerical information less efficiently (Pelegrina et al., 2020). The behavioral component involves avoidance, procrastination, and reluctance to participate, which reduce practice and widen skill gaps over time (Suren, 2020; Siaw, 2021; Choe et al., 2019).

Motivation shapes how students respond to these experiences. Students with strong intrinsic motivation tend to persist through difficulty, and extrinsic incentives can maintain effort under pressure, while weak motivation leads to disengagement (Jeffry, 2025; Garcia, 2023; Cohen et al., 2021; Ramirez et al., 2025). Self-efficacy is a key ingredient, predicting stronger motivation and lower anxiety (Zou & Mustakim, 2025), and self-efficacy together with emotional intelligence can moderate how much anxiety harms performance (Demets et al., 2022). Motivated students can sustain achievement even when moderately anxious (Gunderson et al., 2023; Jameson, 2023).

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The link between anxiety and performance is well documented. Meta-analyses report a consistent negative relationship (Barroso et al., 2020; Zhang et al., 2019), and studies of Filipino senior high school students associate higher anxiety with lower self-efficacy and grades (Ablian & Parangat, 2021; Colinares & Ucang, 2025; Jeffry, 2025). Similar patterns appear in Ghana and South Africa (Essuman et al., 2021; Mutodi & Ngirande, 2014). Students describe mathematics as a subject of fear and frustration that leads to avoidance (Nolasco, 2025), and early experiences of failure can entrench anxiety for years (Ahmmed, 2024; Vanbinst et al., 2020). Classrooms that emphasize mastery and collaboration reduce anxiety (Bicer et al., 2020; Garba, 2019), and structured interventions that combine skill-building with anxiety reduction improve both outcomes (Codding et al., 2023; Pizzie & Kraemer, 2021).

Two theories guided the study. The Integrated Cognitive-Emotional Theory holds that anxiety-related worry consumes working memory and impairs mathematical processing (Ashcraft, 2001; Ashcraft, 2002). Self-Determination Theory separates intrinsic motivation, extrinsic motivation, and amotivation, and treats autonomous, intrinsic motivation as a source of resilience. Within the Philippine policy context, the Enhanced Basic Education Act of 2013 calls for learner-centered and responsive teaching (DepEd, 2013), the Governance of Basic Education Act of 2001 supports identifying and removing barriers to learning (Congress of the Philippines, 2001), and DepEd Order No. 42, s. 2016 encourages evidence-based instructional decisions (DepEd, 2016).

Methodology

Design and participants. The study followed a descriptive-correlational design. The respondents were 109 Grade 11 and Grade 12 students of General Santos City National High School in School Year 2025–2026, chosen by stratified random sampling across strands and sections. Two mathematics teachers with at least three years of experience supplied background on classroom instruction.

Instruments. The questionnaire had three parts. The first collected the students' age, sex, civil status, grade level, track, strand, parents' educational attainment and occupation, and monthly family income. The second measured mathematics anxiety through 20 items adapted from the Abbreviated Math Anxiety Scale and the Modified Abbreviated Math Anxiety Scale, five items for each of the emotional, physiological, cognitive, and behavioral dimensions. The third measured motivation through 15 items adapted from the Academic Motivation Scale, five each for intrinsic motivation, extrinsic motivation, and amotivation. Responses used a four-point agreement scale, and weighted means were interpreted as Very High (3.26–4.00), High (2.51–3.25), Fair (1.76–2.50), or Low (1.00–1.75). Academic performance was measured by first- and second-quarter grades in mathematics taken from official school records.

Validity and reliability. A pilot test with 30 senior high school students of Fatima National High School yielded Cronbach's alpha coefficients of .79 to .84 for the anxiety dimensions and .78 to .85 for the motivation dimensions, indicating acceptable internal consistency. Item wording was refined after the pilot.

Procedure. After approval from the Graduate School and the Schools Division Superintendent of General Santos City, the researchers met the school head to explain the purpose and schedule of the study. The questionnaire was administered during class hours arranged with teachers. Hesitation among some students to share personal experiences was addressed by assuring them of confidentiality, and the researchers rescheduled administration when class activities conflicted. Grades were requested through the school head.

Analysis. Frequencies and percentages summarized the profile, and weighted means summarized each indicator and dimension. Shapiro-Wilk tests showed that the anxiety and motivation scores did not depart significantly from normality (p = .089 to .152). Chi-square tests assessed the relationship of each profile variable with anxiety, motivation, and performance, and Pearson's product-moment correlation assessed the relationship of anxiety and motivation with performance, at $\alpha = .05$.

Ethics. Students gave informed consent, and parents or guardians consented for minors. Participation was voluntary, withdrawal carried no penalty, and data were coded, kept in password-protected storage, and handled in line with the Data Privacy Act of 2012 (Congress of the Philippines, 2012).

Results

Profile of the Respondents

The typical respondent was a 17- to 18-year-old (53.21%), single (97.25%) female (56.88%) in the Academic track (87.16%). Grade 11 (51.38%) and Grade 12 (48.62%) students were almost equally represented. STEM was the largest strand (27.52%), followed by ABM (25.69%), HUMSS (23.85%), TVL (12.85%), and GAS (10.09%). Among parents, completion of high school was the most common educational level (fathers 22.94%, mothers 25.69%), while only 15.60% of fathers and 14.68% of mothers were college graduates. Fathers most often worked as skilled workers (22.94%), and mothers were most often professionals or overseas workers (22.94% each). A quarter of families (25.69%) earned less than ₱10,000 a month and another 29.36% earned ₱10,001 to ₱20,000, so more than half (55.05%) lived on ₱20,000 or less. Only 8.26% earned more than ₱50,000.

Mathematics Anxiety

Table 1

Mathematics Anxiety of the Respondents per Indicator

Dimension and Indicator	Mean	Interpretation
Emotional (overall)	**3.23**	**High**
Nervous when asked to solve problems in front of the class	3.40	Very High
Fear when encountering difficult topics	3.28	Very High
Frustrated easily when making mistakes	3.22	High
Helpless when a lesson is not immediately understood	3.15	High
Avoids math discussions because of anxiety	3.10	High
Physiological (overall)	**3.12**	**High**
Heart beats faster before a math exam	3.35	Very High
Sweats or feels tense during recitations	3.18	High

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Dimension and Indicator	Mean	Interpretation
Feels physically restless during math activities	3.12	High
Stomach discomfort under time pressure	3.05	High
Headaches when studying math for long hours	2.90	High
Cognitive (overall)	**3.23**	**High**
Hard to recall formulas during exams	3.30	Very High
Thinks negatively about ability to succeed	3.25	High
Overwhelmed by the amount of information	3.22	High
Loses focus easily when solving problems	3.20	High
Struggles to concentrate on complex problems	3.18	High
Behavioral (overall)	**2.95**	**High**
Procrastinates on math assignments	3.12	High
Avoids participating in math activities	3.05	High
Hesitates to enroll in advanced math subjects	2.95	High
Skips math classes when unprepared	2.85	High
Prefers not to do group work involving math	2.80	High

Note. 3.26–4.00 = Very High; 2.51–3.25 = High; 1.76–2.50 = Fair; 1.00–1.75 = Low.

Overall, the students' mathematics anxiety was High in every dimension (Table 1). Emotional anxiety (M = 3.23) and cognitive anxiety (M = 3.23) were the strongest, followed by physiological (M = 3.12) and behavioral anxiety (M = 2.95). Four indicators reached the Very High level: nervousness when solving problems in front of the class (3.40), a faster heartbeat before examinations (3.35), difficulty recalling formulas during examinations (3.30), and fear of difficult topics (3.28). The lowest indicators were reluctance to do group work in mathematics (2.80) and skipping classes when unprepared (2.85), both still High.

Motivation

Table 2

Level of Motivation of the Respondents per Indicator

Dimension and Indicator	Mean	Interpretation
Intrinsic (overall)	**3.23**	**High**
Satisfied when understanding a difficult concept	3.35	Very High
Proud when accomplishing math tasks	3.30	Very High
Studies math to genuinely improve skills	3.28	Very High
Finds math interesting and challenging	3.22	High
Enjoys solving problems without external rewards	3.18	High
Extrinsic (overall)	**3.30**	**Very High**
Studies math to get good grades	3.40	Very High
Studies math because it is required for a future career	3.38	Very High
Studies math to meet parents' expectations	3.30	Very High
Works hard because teachers expect it	3.25	High
Engages in math tasks to gain recognition	3.15	High
Amotivation (overall)	**2.28**	**Fair**
Lacks the drive to study math even when necessary	2.40	Fair
Does not see the relevance of math in daily life	2.35	Fair
Gives up easily on math problems	2.30	Fair
Feels that studying math is pointless	2.20	Fair
Feels indifferent toward math performance	2.15	Fair

Note. 3.26–4.00 = Very High; 2.51–3.25 = High; 1.76–2.50 = Fair; 1.00–1.75 = Low.

Extrinsic motivation was Very High (M = 3.30), intrinsic motivation was High (M = 3.23), and amotivation was Fair (M = 2.28) (Table 2). The strongest single reason for studying mathematics was to get good grades (3.40), followed by its importance for a future career (3.38) and the satisfaction of understanding a difficult concept (3.35). Seeking recognition (3.15) and enjoying problems without rewards (3.18) were the weakest motives. Among the amotivation indicators, lacking the drive to study (2.40) and not seeing the relevance of mathematics in daily life (2.35) were highest.

Academic Performance

Mathematics grades were Satisfactory in both quarters. The mean rose from 83.45 in the first quarter to 84.20 in the second, an overall mean of 83.83. The largest group earned 80 to 84 in both quarters (34.86% and 33.03%). Very Satisfactory grades (85–89) increased from 29.36% to 32.11%, and Outstanding grades (90–100) from 16.51% to 20.18%. Fairly Satisfactory grades (75–79) fell from 15.60% to 12.84%, and grades below 75 from 3.67% (4 students) to 1.83% (2 students).

Profile in Relation to Anxiety, Motivation, and Performance

Chi-square tests showed that mathematics anxiety was significantly related to age ($\chi^2 = 10.42$, $p = .03$), sex ($\chi^2 = 8.15$, $p = .04$), grade level ($\chi^2 = 9.36$, $p = .02$), strand ($\chi^2 = 12.28$, $p = .01$), and monthly family income ($\chi^2 = 11.35$, $p = .02$). Motivation was significantly related to the same variables: age ($\chi^2 = 9.84$, $p = .02$), sex ($\chi^2 = 7.65$, $p = .04$), grade level ($\chi^2 = 10.25$, p

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= .01), strand (χ^2 = 11.38, p = .02), and income (χ^2 = 12.41, p = .01). Civil status, track, parents' education, and parents' occupation were not significant for either variable (p = .05 to .32). Academic performance was significantly related only to sex (χ^2 = 8.36, p = .04), grade level (χ^2 = 9.12, p = .02), and strand (χ^2 = 7.28, p = .03), and not to age (p = .11), civil status (p = .33), track (p = .09), parents' education (p = .08), parents' occupation (p = .12), or income (p = .07).

Anxiety and Motivation in Relation to Performance

Table 3

Relationship of Mathematics Anxiety and Motivation With Academic Performance

Variables Correlated	r	p	Strength and Direction
Mathematics anxiety and performance	−.42	.001	Moderate, negative
Motivation and performance	.38	.002	Moderate, positive

Note. Both coefficients significant at p < .05. The original summary table reports a combined coefficient of .382 (p = .002) for the three variables.

Mathematics anxiety had a significant moderate negative relationship with performance (r = −.42, p = .001), and motivation had a significant moderate positive relationship with it (r = .38, p = .002) (Table 3). The null hypothesis of no significant relationship was rejected in both cases.

Discussion

Where anxiety concentrates. The indicator-level results show that the students' anxiety is not a vague dislike of mathematics but a reaction to particular situations. The highest indicators cluster around being watched and being tested: solving problems at the board, the hours before an examination, and recalling formulas while the clock is running. This is the profile of performance-related anxiety, in which fear of public error and evaluation is paired with bodily arousal and a mind that goes blank. The pattern fits the view that worry and emotional distress use up the working memory needed to retrieve and apply procedures (Ashcraft, 2002; Demedts et al., 2022; Finell et al., 2022), and that physiological arousal competes with problem-solving for attention (Esposito et al., 2025; Luttenberger et al., 2018). A faster heartbeat before examinations being rated Very High suggests that, for many students, anxiety starts before the task does, which matches evidence that anticipation alone activates threat responses (Marakshina et al., 2025). Seen against the disrupted schooling and documented mental health strain of Filipino students in the pandemic years (Panela, 2025b), these reactions call for attention to students' emotional readiness as well as their skills.

Behavioral anxiety was the lowest dimension, and the weakest indicators were skipping classes and avoiding group work. Most students therefore keep showing up and taking part even while anxious. The exception is procrastination (3.12), a quieter form of avoidance that limits practice without obvious withdrawal. Over time, such delay can deepen skill gaps and feed the anxiety that produced it (Siaw, 2021; Choe et al., 2019; Suren, 2020). That most students still participate is encouraging: classroom approaches built on collaboration and mastery have room to work (Bicer et al., 2020; Garba, 2019).

What drives effort. Students said they study mathematics mainly for grades, careers, and their parents, and less for enjoyment. Extrinsic motivation can sustain effort, but it can also tie a student's sense of worth to outcomes, which may add to the pressure they feel in evaluative moments. At the same time, intrinsic satisfaction in understanding a difficult concept was rated Very High (3.35), which shows that many students do experience mathematics as rewarding once they succeed. Building on that experience is one way to shift motivation toward more autonomous forms, which are associated with resilience and lower anxiety (Cohen et al., 2021; Jameson, 2023; Gunderson et al., 2023). The two leading amotivation indicators, lack of drive and doubts about relevance, point to a smaller group of students for whom mathematics seems disconnected from their lives. Such disengagement is linked to poorer outcomes (Jeffry, 2025), and relevance-based teaching addresses its source directly.

Performance and its correlates. Performance was Satisfactory and improved across the two quarters despite the high anxiety. The correlations help explain this. Anxiety was associated with lower grades and motivation with higher grades, with effects of similar size in opposite directions. Students who carried more anxiety tended to perform worse, but the cohort's strong motivation appears to have offset part of that drag. The anxiety–performance result is consistent with meta-analytic and local evidence (Barroso et al., 2020; Zhang et al., 2019; Ablian & Parangat, 2021; Colinares & Ucang, 2025), and with studies in other countries (Essuman et al., 2021; Mutodi & Ngirande, 2014). The motivation–performance result agrees with work on the protective role of motivation and self-efficacy (Zou & Mustakim, 2025; Demets et al., 2022). Because the design is correlational, the results show co-occurrence and not causation; it is equally plausible that weaker performance raises anxiety and lowers motivation.

Who is most affected. Response patterns showed higher anxiety among younger students, females, Grade 11 learners, STEM students, and students from lower-income families, while older, Grade 12, STEM and ABM, and higher-income students tended to be more motivated. These patterns align with local findings on age and sex differences (Ablian & Parangat, 2021), with evidence that demographic factors moderate the anxiety–performance link (Barroso et al., 2020), and with research on stereotype threat (Schmader et al., 2021; Lyons & Beilock, 2021). Before such sex differences are treated as real differences in anxiety, however, it is worth confirming that the scale works the same way for both sexes, a step illustrated in recent Rasch-based measurement work in the Philippines (Panela, 2025a). Notably, family income was related to anxiety and motivation but not to grades, and parents' occupation, which in this sample often meant an overseas parent, showed no significant relation to any outcome. Economic hardship thus seems to shape how students feel about mathematics more than how they score, which suggests that support for lower-income learners should address emotional and motivational needs as well as material ones.

Implications for a mental health plan. These results support a school-based plan with four strands. Stress management should target the moments students find most threatening, through relaxation techniques before examinations and low-stakes practice in public problem-solving (Pizzie & Kraemer, 2021; Luttenberger et al., 2018). Confidence-building instruction should

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normalize mistakes and use peer collaboration (Garba, 2019; Codding et al., 2023). Relevance-based lessons should connect mathematics to careers and daily life to raise intrinsic motivation and reduce amotivation. Family engagement should help parents encourage rather than pressure, given that parents' beliefs and anxieties about mathematics are passed on to children (Gunderson et al., 2022; Beilock & Maloney, 2020). Stress-reduction aids for adults in schools have also been evaluated locally, with benefits for workplace stress (Panela, 2026), which suggests the plan should also attend to teachers' well-being.

Conclusion

Senior high school students at General Santos City National High School experience high mathematics anxiety, sharpest in emotional and cognitive forms and in evaluative situations such as public problem-solving and examinations. Their motivation is high but rests mainly on grades, careers, and parents' expectations rather than enjoyment. Their mathematics performance is Satisfactory and improved slightly across the semester. Anxiety and motivation vary with age, sex, grade level, strand, and family income, while performance varies with sex, grade level, and strand. Anxiety is moderately and negatively related to performance, and motivation is moderately and positively related to it.

The school should implement a mental health plan that includes stress-management sessions before examinations, gradual practice in public problem-solving, peer mentoring and counseling, strand-specific support for STEM and ABM learners, lessons linking mathematics to real-life applications, and parent workshops. Lower-income students should have equitable access to learning materials and tutoring, and anxiety, motivation, and performance should be monitored every quarter. Teachers will need professional development in anxiety-informed and autonomy-supportive pedagogy; designing it around a clear map of their current competencies (Panela, 2025d) and the practical barriers they encounter when adopting new practices (Panela, 2025e) would make it more effective. Further research with larger samples, regression or path analysis, and longitudinal follow-up is recommended to test whether anxiety and motivation predict later performance. Given the high anxiety reported across the cohort, the after-effects of the pandemic on learners' mental health should also continue to be monitored (Panela, 2025c).

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