IJIMR
INTERNATIONAL JOURNAL OF INNOVATIVE AND MULTIDISCIPLINARY RESEARCH

ISSN: 3116-5990 online / 3116-5982 print
Volume 1 Issue No. 4
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DOI: https://doi.org/10.66206/eduheart.ijimr.45

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

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ARTICLE INFO

Date Received: September 15, 2026
Date Reviewed: September 30, 2026
Date Accepted: October 30, 2026
Date Published: November 20, 2026

KEYWORDS

academic achievement; mathematics grades; mathematics anxiety; motivation; senior high school; public school

ABSTRACT

Mathematics grades in senior high school influence students' college and career prospects, yet the affective factors behind those grades are rarely examined with actual school records. This descriptive-correlational study described the mathematics achievement of 109 Grade 11 and 12 students of General Santos City National High School across the first and second quarters of School Year 2025–2026 and examined its relationship with their profile, mathematics anxiety, and level of motivation. Grades were taken from school records; anxiety and motivation were measured using instruments adapted from the Abbreviated Math Anxiety Scale and the Academic Motivation Scale (α = .78 to .85). Achievement was Satisfactory and improved from a mean of 83.45 to 84.20, with students earning 85 or higher increasing from 45.87% to 52.29%. Achievement was significantly related to sex, grade level, and strand, but not to family income. Students reported High anxiety, particularly in emotional and cognitive dimensions (M = 3.23), with the highest indicators tied to recitations and examinations. Motivation was largely extrinsic (M = 3.30), with good grades as the leading reason for studying. Mathematics anxiety was negatively related to achievement (r = −.42, p = .001), and motivation was positively related to it (r = .38, p = .002). Grades appear to reflect students' emotional responses to evaluative situations as well as their knowledge. A mental health plan centered on assessment readiness, early support for low achievers, and relevance-based motivation is proposed.

Introduction

Academic achievement in mathematics is one of the clearest indicators of whether senior high school is preparing students for what comes next. Grades in mathematics shape admission to college programs, scholarship eligibility, and students' own sense of whether they belong in technical and scientific fields. In the Philippines, the K to 12 reform sought to strengthen this preparation through specialized tracks and strands (DepEd, 2013), yet assessments continue to show many learners below proficiency in mathematics.

Explanations for low achievement often focus on content knowledge and instruction. An equally important set of explanations concerns students' affective and motivational states. Mathematics anxiety lowers confidence, motivation, and performance in STEM fields (Gunderson et al., 2023) and depresses test scores and enrollment in advanced courses (Rachman et al., 2023). Motivation, by contrast, can help students persist. Philippine studies have mostly examined anxiety without considering motivation (Colinares & Ucang, 2025; Ablian & Parangat, 2021), and few have used actual school grades across more than one

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DOI: https://doi.org/10.66206/eduheart.ijimr.45

grading period as the measure of achievement. At General Santos City National High School, where teachers report recurring signs of mathematics anxiety, no study has related students' grades to both their anxiety and their motivation.

This study placed academic achievement at the center. It described the mathematics achievement of senior high school students across the first and second quarters of School Year 2025–2026, identified which personal and family characteristics were related to that achievement, described the students' levels of mathematics anxiety and motivation, and determined whether anxiety and motivation were significantly related to achievement. The results were used to propose a mental health plan to support achievement in mathematics.

Literature Review

Achievement and anxiety. A large body of evidence shows that higher mathematics anxiety goes with lower achievement. Meta-analyses confirm a consistent negative relationship across ages and countries (Barroso et al., 2020; Zhang et al., 2019). In the Philippines, anxiety has been associated with lower self-efficacy and grades among senior high school students (Ablian & Parangat, 2021), negative early experiences have been tied to persistent anxiety and weaker achievement (Colinares & Ucang, 2025), and a moderate inverse correlation between anxiety and grades has been reported (Jeffry, 2025). Comparable results have been found in Ghana (Essuman et al., 2021) and South Africa (Mutodi & Ngirande, 2014). The relationship is likely reciprocal: poor performance raises anxiety, and anxiety then impairs later performance (Ahmmed, 2024; Rubinsten et al., 2015).

How anxiety reduces achievement. Mathematics anxiety is a state of tension and fear that disrupts the handling of numbers and problems (Ashcraft, 2002; Suren, 2020). Its cognitive component, made up of worry and intrusive thoughts, limits working memory (Demedts et al., 2022), which mediates the effect of anxiety on performance (Finell et al., 2022) and impairs the updating of numerical information (Pelegrina et al., 2020). Its physiological component diverts attention (Esposito et al., 2025; Lievore et al., 2024; Luttenberger et al., 2018). Its emotional component of fear and frustration reduces interest (Baas, 2020; Ramirez et al., 2025; Garcia, 2023), and its behavioral component of avoidance and procrastination cuts practice time (Siaw, 2021; Choe et al., 2019). Each of these pathways can reduce grades.

Achievement and motivation. Motivation supports achievement by sustaining effort and persistence. Students with strong intrinsic motivation handle difficulty better, and extrinsic incentives can maintain effort, while low motivation leads to disengagement (Jeffry, 2025; Cohen et al., 2021; Jameson, 2023). Self-efficacy predicts motivation and lower anxiety (Zou & Mustakim, 2025), self-efficacy and emotional intelligence moderate the effect of anxiety on performance (Demets et al., 2022), and motivation helps students achieve despite moderate anxiety (Gunderson et al., 2023; Ramirez et al., 2023).

Contextual influences. Achievement and anxiety are also shaped by context. Parents' and teachers' beliefs about mathematics influence students' anxiety (Gunderson et al., 2022; Beilock & Maloney, 2020), stereotypes affect some groups' performance (Schmader et al., 2021; Lyons & Beilock, 2021), and supportive, collaborative, and mastery-oriented classrooms

reduce anxiety and raise achievement (Bicer et al., 2020; Garba, 2019; Codding et al., 2023). The study was framed by the Integrated Cognitive-Emotional Theory, which links anxiety to reduced working memory (Ashcraft, 2001), and by Self-Determination Theory, which explains how different forms of motivation sustain or weaken engagement. Its legal basis includes the Governance of Basic Education Act of 2001 (Congress of the Philippines, 2001) and DepEd Order No. 42, s. 2016, which calls for research-informed instruction (DepEd, 2016).

Methodology

Design, Setting, and Respondents

This descriptive-correlational study was conducted at General Santos City National High School, a large public secondary school in General Santos City, during School Year 2025–2026. The respondents were 109 senior high school students from Grades 11 and 12, chosen by stratified random sampling so that the different strands and sections would be represented. Two mathematics teachers with at least three years of experience provided supplementary information.

Measures

Academic achievement, the central variable, was measured using each student's first- and second-quarter mathematics grades from official school records, classified according to the DepEd grading descriptors: Outstanding (90–100), Very Satisfactory (85–89), Satisfactory (80–84), Fairly Satisfactory (75–79), and Did Not Meet Expectations (below 75). Mathematics anxiety was measured through a 20-item scale adapted from the Abbreviated Math Anxiety Scale and the Modified Abbreviated Math Anxiety Scale, covering emotional, physiological, cognitive, and behavioral dimensions. Motivation was measured through a 15-item scale adapted from the Academic Motivation Scale, covering intrinsic motivation, extrinsic motivation, and amotivation. Both used a four-point agreement scale with means interpreted as Very High (3.26–4.00), High (2.51–3.25), Fair (1.76–2.50), or Low (1.00–1.75). A profile sheet recorded age, sex, civil status, grade level, track, strand, parents' education and occupation, and family income. Pilot testing with 30 students from Fatima National High School produced alpha coefficients of .78 to .85.

Procedure, Analysis, and Ethics

With approval from the Graduate School, the Schools Division Superintendent, and the school head, the researchers administered the questionnaires during class hours and obtained grades through the school head's office. Hesitant students were reassured about confidentiality, and administration was rescheduled around class conflicts. The data were analyzed using frequency, percentage, mean, chi-square, and Pearson's r, with $\alpha = .05$; the Shapiro-Wilk test indicated normally distributed anxiety and motivation scores. Written consent was obtained from students and from parents of minors, participation was voluntary, and personal data were protected under the Data Privacy Act of 2012 (Congress of the Philippines, 2012).

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DOI: https://doi.org/10.66206/eduheart.ijimr.45

Results and Discussion

Mathematics Achievement Across Two Quarters

Table 1

Distribution of Mathematics Grades and Change From the First to the Second Quarter

Descriptor (Range)	Q1 f (%)	Q2 f (%)	Change (pp)
Outstanding (90–100)	18 (16.51)	22 (20.18)	+3.67
Very Satisfactory (85–89)	32 (29.36)	35 (32.11)	+2.75
Satisfactory (80–84)	38 (34.86)	36 (33.03)	−1.83
Fairly Satisfactory (75–79)	17 (15.60)	14 (12.84)	−2.76
Did Not Meet Expectations (Below 75)	4 (3.67)	2 (1.83)	−1.84
Mean grade	**83.45**	**84.20**	**+0.75**

Note. pp = percentage points. Overall mean = 83.83 (Satisfactory).

Mathematics achievement was Satisfactory in both quarters, and the distribution shifted upward over the semester (Table 1). The mean grade increased by 0.75 points, from 83.45 to 84.20. The Outstanding group grew by 3.67 percentage points and the Very Satisfactory group by 2.75 points, while the Fairly Satisfactory group shrank by 2.76 points and the group below 75 by 1.84 points. By the second quarter, more than half of the students (52.29%) were earning 85 or above, compared with 45.87% in the first quarter.

Two readings of this result are worth separating. First, the cohort as a whole is achieving at an adequate level and improving, which suggests that classroom instruction and students' effort are paying off over time. Second, about one in seven students remained in the two lowest bands in the second quarter (14.67%), and these students are the most likely to be held back by anxiety and amotivation. The upward movement agrees with evidence that motivated students sustain achievement under anxiety (Gunderson et al., 2023), while the persistent lower tail agrees with evidence that anxiety continues to depress grades for some learners (Jeffry, 2025; Colinares & Ucang, 2025).

Who Achieves: Profile and Achievement

The respondents were mostly 17 to 18 years old (53.21%), female (56.88%), single (97.25%), and in the Academic track (87.16%). Grade 11 and Grade 12 accounted for 51.38% and 48.62%. STEM (27.52%) and ABM (25.69%) were the largest strands. Most parents had completed high school, and 55.05% of families earned ₱20,000 or less per month.

Table 2

Chi-Square Tests of the Relationship Between Profile Variables and Mathematics Achievement

Profile Variable	χ^2	p	Decision	Interpretation
Age	6.42	.11	Fail to reject H_0	Not significant
Sex	8.36	.04	Reject H_0	Significant
Civil status	2.25	.33	Fail to reject H_0	Not significant
Grade level	9.12	.02	Reject H_0	Significant
Track	5.84	.09	Fail to reject H_0	Not significant
Strand	7.28	.03	Reject H_0	Significant
Parents' educational attainment	6.45	.08	Fail to reject H_0	Not significant
Parents' occupation	4.92	.12	Fail to reject H_0	Not significant
Combined monthly family income	7.15	.07	Fail to reject H_0	Not significant

Only three profile variables were significantly related to achievement: sex ($\chi^2 = 8.36$, $p = .04$), grade level ($\chi^2 = 9.12$, $p = .02$), and strand ($\chi^2 = 7.28$, $p = .03$) (Table 2). Female students, Grade 12 students, and STEM and ABM students tended to obtain higher grades. Age, civil status, track, parents' education, parents' occupation, and family income were not significantly related to achievement, although income ($p = .07$) and parents' education ($p = .08$) approached significance.

These results show that school-related characteristics matter more for grades than family background. Grade 12 students have had an additional year to adjust to senior high school, and STEM and ABM students take more mathematics-intensive subjects and may have chosen those strands because of prior aptitude. The higher grades of female students are notable because the same students also reported higher anxiety. Female students therefore appear to achieve well while carrying more anxiety, which points to effort or motivation compensating for anxiety rather than the absence of anxiety. Interpreting sex differences of this kind is safer when the instrument has been shown to measure the construct equivalently for male and female respondents, as Rasch-based analysis of teacher scales in the Philippines has shown (Panela, 2025a). The absence of a significant link between income and grades contrasts with the significant links between income and both anxiety and motivation ($\chi^2 = 11.35$ and 12.41). Economic disadvantage appears to affect students' emotional and motivational states more than their recorded grades.

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DOI: https://doi.org/10.66206/eduheart.ijimr.45

Table 3

Highest and Lowest Indicators per Dimension of Mathematics Anxiety and Motivation

Dimension	Mean	Highest Indicator	Lowest Indicator
Anxiety			
Emotional	3.23	Nervous when asked to solve problems in front of the class (3.40)	Avoids math discussions because of anxiety (3.10)
Physiological	3.12	Heart beats faster before a math exam (3.35)	Headaches when studying math for long hours (2.90)
Cognitive	3.23	Hard to recall formulas during exams (3.30)	Struggles to concentrate on complex problems (3.18)
Behavioral	2.95	Procrastinates on math assignments (3.12)	Prefers not to do group work involving math (2.80)
Motivation			
Intrinsic	3.23	Satisfied when understanding a difficult concept (3.35)	Enjoys solving problems without external rewards (3.18)
Extrinsic	3.30	Studies math to get good grades (3.40)	Engages in math tasks to gain recognition (3.15)
Amotivation	2.28	Lacks the drive to study math even when necessary (2.40)	Feels indifferent toward math performance (2.15)

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

Mathematics anxiety was High in all dimensions (Table 3). Emotional and cognitive anxiety were highest (3.23), followed by physiological (3.12) and behavioral anxiety (2.95). The highest indicator in each dimension refers to an evaluative moment: solving problems in front of the class (3.40), the heartbeat before an examination (3.35), recalling formulas during examinations (3.30), and putting off assignments (3.12). The lowest indicators, including headaches during long study sessions (2.90) and avoiding group work (2.80), concern situations without immediate evaluation.

For achievement, this pattern is significant because grades are largely built on the very situations students fear most: quizzes, examinations, and recitations. When students forget formulas during examinations or freeze at the board, their grades reflect anxiety as well as understanding. This is consistent with evidence that worry and arousal compete for working memory during tasks (Demedts et al., 2022; Finell et al., 2022; Esposito et al., 2025; Luttenberger et al., 2018) and that procrastination reduces practice (Siaw, 2021). The pattern also agrees with accounts of fear and frustration in mathematics among Filipino learners (Nolasco, 2025) and with the heightened emotional strain documented among Filipino students since the pandemic (Panela, 2025b).

Motivation was dominated by extrinsic reasons (3.30, Very High), especially good grades (3.40), followed by intrinsic motivation (3.23, High), with amotivation Fair (2.28). Students' strongest reason for studying mathematics is thus the achievement outcome itself. This orientation helps explain the upward trend in grades, since students working toward grades and careers keep investing effort. It may, however, also feed anxiety, because when grades are the main goal every assessment carries high stakes. The lowest intrinsic indicator, enjoying

problems without rewards (3.18), and the leading amotivation indicators, lack of drive (2.40) and doubts about relevance (2.35), identify where interest could be built.

Relationship of Anxiety and Motivation with Achievement

Table 4

Pearson Correlation of Mathematics Anxiety and Motivation with Mathematics Achievement

Variable	r	p	r^2	Interpretation
Mathematics anxiety	−.42	.001	.18	Moderate negative, significant
Motivation	.38	.002	.14	Moderate positive, significant

Achievement was significantly related to both variables (Table 4). Higher anxiety was associated with lower grades ($r = -.42$, $p = .001$), and higher motivation with higher grades ($r = .38$, $p = .002$). Considered separately, anxiety shares about 18% of its variance with achievement and motivation about 14%. These figures cannot simply be added, because anxiety and motivation are likely related to each other.

The findings align with the meta-analytic consensus on anxiety (Barroso et al., 2020; Zhang et al., 2019), with Philippine studies (Ablian & Parangat, 2021; Jeffry, 2025), and with evidence on the protective role of motivation (Gunderson et al., 2023; Demets et al., 2022; Zou & Mustakim, 2025). They show that a meaningful share of the differences in students' grades is associated with how anxious and how motivated they are, beyond what they know. Because the data are correlational and were collected at one point in the semester, the results cannot show whether anxiety lowers grades or low grades raise anxiety; most likely both occur (Rubinsten et al., 2015).

Supporting Achievement Through a Mental Health Plan

An achievement-focused mental health plan follows from these findings. Because grades depend on evaluative situations, the plan should prepare students for those situations through relaxation and reappraisal before examinations, gradual and supportive practice in public problem-solving, and review routines that strengthen recall under pressure (Pizzie & Kraemer, 2021; Cohen et al., 2021). Because the lower tail of achievement persists, students in the Fairly Satisfactory and failing bands should receive early identification, tutoring, peer mentoring, and counseling (Codding et al., 2023; Garba, 2019). Because motivation is largely grade-driven, teachers should complement grades with relevance and mastery goals so that assessments feel less threatening (Bicer et al., 2020). Because sex, grade level, and strand matter, support should be targeted, for instance toward Grade 11 students and toward the anxiety of high-achieving female and STEM learners. The plan can draw on Philippine experience in building teachers' capacity through action research, which shows how barriers to implementation can be identified and addressed in schools (Panela, 2025e).

Conclusion

The mathematics achievement of senior high school students at General Santos City National High School is Satisfactory and improved between the first and second quarters, though a small group continues to perform at the lowest levels. Achievement is related to sex, grade level, and

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DOI: https://doi.org/10.66206/eduheart.ijimr.45

strand, but not to family income or parents' education and occupation. The students experience High mathematics anxiety, concentrated in the evaluative situations through which grades are earned, and their motivation is high but largely driven by grades and careers. Mathematics anxiety is moderately and negatively related to achievement, and motivation moderately and positively related to it.

To sustain and broaden achievement, the school should implement a mental health plan for mathematics learners that includes test-preparation and stress-management sessions, confidence-building practice, peer mentoring and counseling, strand-specific support, relevance-based lessons, and parent workshops, together with equitable learning resources for lower-income students and quarterly monitoring of anxiety, motivation, and grades. Teachers should receive training in anxiety-informed and autonomy-supportive pedagogy, guided by an assessment of their existing skills and competencies (Panela, 2025d). Their own well-being deserves attention as well, and simple stress-management tools have shown promise among Filipino employees (Panela, 2026). Monitoring should also track the longer-term mental health effects of the pandemic on learners (Panela, 2025c). Future research should use more grading periods and regression-based analyses to clarify how anxiety and motivation shape achievement over time.

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ISSN: 3116-5990 online / 3116-5982 print
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