

Original Article

How Resilience, Academic Stress, and College Readiness Influence Mathematics Performance

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Abstract. First-year students in teacher education programs frequently struggle with mathematics, yet the combined influence of resilience, stress, and college readiness on their academic outcomes remains insufficiently explored. Grounded in Resilience Theory (Masten, 2001), the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), and College Readiness Theory (Conley, 2007), this study examined how adversity quotient (AQ), academic stress, and college readiness jointly predict mathematics performance among 189 BEEd and BSEd first-year students at Cagayan State University-Aparri. Using total enumeration sampling and validated, adapted instruments, data were analyzed using descriptive statistics, comparative tests, and hierarchical multiple regression. Students reported high AQ ($M = 3.84$), high academic stress ($M = 3.81$), and moderate-to-high college readiness ($M = 3.53$), with an overall high mathematics performance ($M = 87.14$). Only academic stress ($\beta = -0.934$, $p = .002$) and parental income ($\beta = 0.0008$, $p = .012$) significantly predicted performance, accounting for 8% of the variance. AQ and college readiness showed no direct predictive effects once stress and demographics were controlled. These findings suggest that stress appraisal is a more proximal influence on mathematics achievement than dispositional resilience or readiness, pointing to the urgency of stress-regulation programs and socioeconomic support in teacher education.

Keywords: Academic stress; College readiness; Mathematics performance; Resilience; Teacher education.

Mathematics performance is a critical benchmark of academic achievement in teacher education, where content mastery directly shapes future instructional effectiveness. Globally, mathematics achievement gaps persist, disproportionately affecting socioeconomically disadvantaged students (OECD, 2019; OECD, 2022). In the Philippines, PISA 2022 results revealed that only 16% of 15-year-olds reached Level 2 mathematics proficiency, far below the OECD average of 69% (OECD, 2022). These systemic gaps compound in teacher education, undermining the instructional confidence of future educators.

Contemporary research recognizes that academic performance is shaped not only by cognitive ability but also by psychosocial and contextual factors (Pascoe et al., 2020; Gong et al., 2023). Three theoretically interconnected constructs are central to this study: Adversity Quotient (AQ), academic stress, and college readiness. Though each addresses a distinct dimension of student experience, they converge in influencing how students engage with and perform in cognitively demanding subjects like mathematics.

This study is grounded in three complementary frameworks. Resilience Theory (Masten, 2001) frames AQ—

originally conceptualized through Stoltz's (1997) CORE model (Control, Ownership, Reach, Endurance) as a measurable expression of dispositional resilience that enables students to persist through academic adversity. Martin and Marsh (2006) distinguished between academic buoyancy, relevant to everyday setbacks, and resilience, relevant to chronic or severe adversity; both protect against disengagement, though direct performance effects depend more on task-specific cognitive strategies (Martin, 2013).

The Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) frames academic stress as emerging from students' appraisals of demands as exceeding coping resources. Eysenck et al.'s (2007) Attentional Control Theory explains how anxiety redirects working memory from task-relevant processing to threat-related cognitions, impairing the multi-step problem-solving essential for mathematics (Ashcraft & Krause, 2007). A meta-analysis of 906,311 participants confirmed that mathematics and test anxiety exert significant negative effects on mathematics achievement (Caviola et al., 2022).

College Readiness Theory (Conley, 2007, 2010) conceptualizes readiness as encompassing key cognitive strategies, content knowledge, academic behaviors, and contextual skills. Within self-regulated learning frameworks, readiness reflects students' capacity to plan, monitor, and adapt their learning (Zimmerman, 2002). Though readiness is associated with long-term academic persistence (Hernández et al., 2020), its direct predictive value for specific course performance remains mixed.

Together, these frameworks propose a layered explanatory model: AQ (dispositional resilience) may buffer stress responses; academic stress directly impairs performance through cognitive interference; and college readiness enables self-regulatory behaviors, with indirect effects on performance. Despite this coherence, existing research rarely examines these constructs simultaneously, few studies use theory-driven hierarchical modeling to isolate their incremental contributions, and investigations in Philippine teacher education—especially among first-year students in the critical secondary-to-tertiary transition—remain scarce.

At Cagayan State University–Aparri, mathematics instructors observe that students' difficulties with Mathematics in the Modern World are not purely cognitive but also rooted in low resilience, heightened stress, and insufficient college-level preparedness. This study investigates the extent to which AQ, academic stress, and college readiness predict mathematics performance among first-year BEEd and BSEd students, employing hierarchical regression to examine their relative and incremental contributions beyond socio-demographic factors.

Methodology

Research Design

This study employed a quantitative, cross-sectional explanatory design to investigate predictive relationships among AQ, academic stress, college readiness, and mathematics performance. Hierarchical multiple regression was the primary analytic method, with predictors entered in theory-driven sequential blocks—background variables first, followed by psychosocial constructs—reflecting the integrated theoretical framework (Creswell & Creswell, 2018).

Participants and Sampling

The sample comprised 189 first-year teacher education students (88 BEEd; 101 BSEd: 34 Mathematics, 24 Science, 43 English specializations) enrolled in Mathematics in the Modern World at Cagayan State University–Aparri during AY 2024–2025. Total enumeration sampling was applied to the accessible population to maximize representativeness and statistical power.

Research Instrument

Three validated instruments were adapted for the study. AQ was measured using Stoltz's (1997) Adversity Response Profile, reworded for academic contexts across seven dimensions: Control, Ownership, Reach, Endurance, Problem-Solving Skills, Emotional Resilience, and Adaptability. Academic stress was assessed using Gadzella's (1991) Student-Life Stress Inventory, contextualized for mathematics coursework across seven dimensions: Academic Pressure, Time Management Difficulties, Performance Anxiety, Interpersonal Stress, Physical Manifestations, Emotional Responses, and Perceived Inadequacy. College readiness used Conley's (2007, 2010) framework across four dimensions: Key Cognitive Strategies, Key Content Knowledge, Academic Behaviors, and Contextual Skills and Awareness. All scales used five-point Likert formats. Mathematics performance was operationalized using official final grades. Three expert validators confirmed content validity;

internal consistency was acceptable across all scales (Cronbach's $\alpha \geq .70$).

Data Collection and Analysis

Data were collected face-to-face over three weeks during the second semester of AY 2024–2025. Statistical assumption testing—normality (skewness/kurtosis within ± 2 ; Shapiro-Wilk), linearity (scatterplots), homoscedasticity (residual plots), multicollinearity (VIF: 1.12–2.43), and outlier diagnostics (standardized residuals within ± 3 ; Cook's Distance < 1.0)—confirmed all conditions for parametric analyses. Descriptive statistics, t-tests, one-way ANOVA (with post-hoc LSD), Pearson correlations, and hierarchical regression were conducted at the $\alpha = .05$ level. Informed consent was obtained; anonymity and confidentiality were maintained throughout.

Ethical Considerations

The study adhered to established ethical standards. Participants provided written informed consent following structured orientation. Participation was voluntary; students could decline or withdraw without penalty. Anonymity was maintained through numerical coding; data were stored in password-protected files. Ethical clearance was obtained from the appropriate institutional review body prior to data collection.

Results and Discussion

Socio-Demographic and Academic Profile

Table 1. *Distribution of the students in terms of their socio-demographic profile*

Socio-Demographic Profile Variables	Frequency	Percentage (%)
Age		
18-19	173	91.53%
20-21	8	4.23%
22-above	8	4.23%
Sex		
Female	147	77.78%
Male	42	22.22%
Parent's Monthly Income		
Below Php5,000	84	44.44%
Php5001-Php10,000	74	39.15%
Php10,001-Php15,000	18	9.52%
Php15,001-Php20,000	8	4.23%
20,0001 and above	5	2.65%
Mothers' Highest Educational Attainment		
Master's Degree Holder	6	3.17%
Bachelor's Degree Holder	15	7.94%
High School Graduate	77	40.74%
High School Level	32	16.93%
Elementary Graduate	17	8.99%
Elementary Level	42	22.22%
Father's Highest Educational Attainment		
Bachelor's Degree Holder	34	17.99%
High School Graduate	71	37.57%
High School Level	42	22.22%
Elementary Graduate	26	13.76%
Elementary Level	16	8.47%

Respondents ($N = 189$) were predominantly aged 18–19 years (91.53%; $M = 18.90$, $SD = 1.66$), consistent with the typical cohort entering Philippine higher education following the K–12 reform. The relative age homogeneity of this group is methodologically advantageous: by minimizing developmental variation in executive functioning and cognitive maturation, it reduces confounding in the interpretation of psychosocial predictors (Steinberg, 2005). Female students comprised 77.78% of the sample, mirroring the well-documented and persistent feminization of teacher education both in the Philippines and internationally (UNESCO, 2023). This demographic skew is analytically relevant, as female and male students tend to differ systematically in stress appraisal, coping orientations, and academic help-seeking behaviors (Matud, 2004; Putwain & Daly, 2020)—differences that may shape how psychosocial variables relate to academic outcomes across genders.

Economically, the sample is strikingly disadvantaged: 83.59% of households earned less than ₱10,000 per month ($M = ₱8,717.99$, $SD = ₱5,816.36$). This profile resonates with OECD (2022) PISA data showing that 36% of Filipino students fall in the lowest international socioeconomic quintile. The well-established socioeconomic achievement gradient – documented meta-analytically with a moderate effect size ($r = .28$; Sirin, 2005) – suggests that structural economic conditions create either conditions conducive to or conditions constraining academic success. Crucially, these economic realities are not merely background noise; they shape students' daily lived experience in ways that interact with stress appraisal, resilience resources, and college preparedness. A student managing financial precarity alongside academic demands faces compounding cognitive and emotional loads that are difficult to disentangle from classroom performance.

Table 2. *Distribution of the students in terms of their academic profile*

Academic Profile Variables	Frequency	Percentage (%)
Course		
Bachelor of Elementary Education (BEED)	88	53.44%
Bachelor of Secondary Education (BSED)	101	46.56%
Specialization		
Math	34	17.99%
English	43	22.75%
Science	24	12.70%
Generalist	88	46.56%

Parental education was similarly modest: 40.74% of mothers and 37.57% of fathers had completed only high school. Davis-Kean (2005) established that parental educational attainment influences children's academic achievement through multiple pathways – academic expectations, quality of the home learning environment, and direct involvement in schoolwork. In the Philippine context, where first-generation college students are common in teacher education programs, limited parental academic capital may translate into reduced early scaffolding for college-level demands, potentially amplifying the challenges captured by the college readiness construct. The near parity between BEED (53.44%) and BSED (46.56%) enrollees reflects national enrollment trends, though the low representation of Mathematics (17.99%) and Science (12.70%) specializations is noteworthy given the persistent shortage of STEM-qualified teachers in Philippine basic education (OECD, 2022) – a gap that ultimately feeds back into the cycle of poor mathematics outcomes observed at the K-12 level.

Students' Adversity Quotient

Students demonstrated uniformly high AQ across all seven dimensions (composite $M = 3.84$; Table 3), with Endurance as the strongest dimension ($M = 4.14$), followed by Ownership ($M = 3.98$) and Reach ($M = 3.93$). The salience of Endurance is theoretically significant: within Stoltz's (1997) CORE framework, endurance reflects the degree to which students perceive adversity as temporary and manageable rather than permanent and pervasive. High scores here suggest these students are oriented toward persistence. This cognitive stance aligns closely with Dweck's (2006) growth mindset, wherein setbacks are attributed to insufficient effort or strategy rather than fixed ability. Similarly, high Ownership scores indicate a strong internal locus of causation: students are willing to take responsibility for difficulties and initiate corrective action, rather than attributing problems solely to external circumstances.

Table 3. *Students' adversity quotient*

Students' Adversity Quotient	Weighted Mean	Descriptive Value
Control	3.70	High
Ownership	3.98	High
Reach	3.93	High
Endurance	4.14	High
Problem-Solving Skills	3.55	High
Emotional Resilience	3.69	High
Adaptability	3.91	High
Composite Mean	3.84	High

The comparatively lower scores on Problem-Solving Skills ($M = 3.55$) and Emotional Resilience ($M = 3.69$) introduce an important nuance. These dimensions tap into the behavioral and affective execution of resilience – not just the disposition toward it. A student may strongly believe that difficulties are temporary (Endurance) and accept accountability (Ownership) while still lacking the concrete strategies to systematically work through complex mathematical problems or the emotional regulation skills to recover quickly from academic setbacks.

This gap between orientational resilience and functional resilience competencies has practical implications: it suggests that resilience programs should not merely affirm positive attitudes toward adversity but should actively cultivate structured problem-solving approaches and emotional coping skills, particularly in mathematics-intensive contexts. These findings are consistent with AQ research among Filipino college students, which similarly highlights ownership and endurance as dominant dimensions (Española, 2016), and with Putri et al. (2024), who found that AQ supports stress management through enhanced self-control and coping repertoires.

Notably, despite these high AQ levels, resilience did not emerge as a significant direct predictor of mathematics performance in the hierarchical regression analysis. This finding, while perhaps counterintuitive, is theoretically coherent. Martin and Marsh (2006, 2009) argued persuasively that resilience-related constructs buffer students against disengagement and dropout—particularly under severe or chronic adversity—but do not necessarily translate into superior performance on specific academic tasks. In the present study, where students were functioning within a normative first-year academic environment with relatively high overall performance ($M = 87.14$), the conditions that would differentiate students based on resilience may not have been sufficiently extreme to produce detectable performance effects. Furthermore, the constrained variability in AQ scores (floor-level dispersion across a high-scoring sample) may have produced a statistical ceiling effect, limiting the variance available for regression to explain (Cohen et al., 2003). Putwain et al. (2023) further clarified that the pathway from academic buoyancy to mathematics achievement operates indirectly through self-efficacy—a mediator not measured in the present study. AQ thus appears to function as an enabling background construct: it sustains motivation and supports stress regulation, but its influence on course-level performance is more likely mediated than direct.

Students' Academic Stress

Students reported uniformly high academic stress across all seven dimensions (composite $M = 3.81$; Table 4), with Academic Pressure ($M = 4.09$) and Performance Anxiety ($M = 3.95$) the highest. The overall stress level is consistent with epidemiological estimates placing 47%–55% of university students in the moderate-to-high stress range (Asensio-Martínez et al., 2023), and aligns with evidence that students in mathematically intensive programs report stress levels associated with the highest dropout rates in higher education (Feser et al., 2023; Lahme et al., 2024). What is particularly striking in this sample, however, is that even the lowest-scoring dimension—Perceived Inadequacy ($M = 3.50$)—still falls within the high descriptive category. This uniformity suggests that stress is not a localized or domain-specific experience for these students; it is a pervasive psychosocial state that permeates multiple facets of their academic life.

Table 4. *Summary of students' level of academic stress*

Students' Academic Stress	Weighted Mean	Descriptive Value
Academic Pressure	4.09	High
Time Management Difficulties	3.88	High
Performance Anxiety	3.95	High
Interpersonal Stress	3.59	High
Physical Manifestations	3.78	High
Emotional Responses	3.84	High
Perceived Inadequacy	3.50	High
Composite Mean	3.81	High

The elevation of Academic Pressure and Performance Anxiety merits targeted theoretical attention. Academic Pressure captures the objective demand load—deadlines, examinations, course expectations—while Performance Anxiety reflects the subjective appraisal of one's capacity to meet those demands. Together, they operationalize the core of Lazarus and Folkman's (1984) Transactional Model: stress is not merely the presence of demands, but the cognitive appraisal that demands outstrip available coping resources. When students perceive that the standards required to succeed in Mathematics in the Modern World exceed their preparation or capacity, anxiety is activated—and this has direct, measurable cognitive consequences. Eysenck et al.'s (2007) Attentional Control Theory specifies the mechanism: anxiety disrupts the central executive functions of working memory by shifting attentional resources away from task-relevant problem-solving processes toward threat-monitoring cognitions (self-doubt, fear of failure, worry about evaluation). Because mathematics is fundamentally working-memory dependent—requiring the simultaneous encoding, manipulation, and retrieval of numerical information across multi-step procedures—even moderate anxiety-induced interference can produce meaningful performance

decrements (Ashcraft & Krause, 2007). Pellizzoni et al. (2022) provided longitudinal evidence for this pathway, demonstrating that mathematics anxiety impairs working memory over time, which in turn reduces mathematics achievement. Zhang et al. (2024) further identified time pressure, task complexity, and fear of failure as specific amplifiers of this anxiety-performance relationship – all features inherent in high-stakes mathematics coursework.

The regression analysis confirmed academic stress as the strongest and most consistent predictor of mathematics performance in this study ($\beta = -0.934$, $p = .002$, $\Delta R^2 = .048$). Interpreted substantively, each one-unit increase on the stress scale corresponds to approximately a 0.93-point decline in mathematics grades, holding all other variables constant. This effect size, while modest in absolute terms, is meaningful given the restricted grade range in the sample and consistent with the theoretical expectation that stress appraisal operates as a proximal cognitive-performance mechanism—one that directly activates the attentional and mnemonic disruptions that undermine mathematical reasoning. The finding converges with Pascoe et al.'s (2020) systematic review documenting stress as broadly detrimental to academic outcomes, and with Gong et al. (2023), who found that academic stress predicted learning burnout among Chinese university students even after accounting for psychological resilience—suggesting that stress effects on performance are not easily neutralized by high general resilience. Souto-Gestal et al. (2025), similarly, using hierarchical regression, found that academic stressors predicted cognitive and physical stress responses that impair performance execution. Taken together, the evidence positions stress appraisal not as one factor among many equally weighted influences, but as the dominant proximal pathway through which psychosocial experiences translate into academic outcomes in mathematics.

Students’ College Readiness

Students demonstrated moderate-to-high college readiness (composite M = 3.53; Table 5), classified as "Ready" across all four dimensions. Key Content Knowledge (M = 3.62) and Key Cognitive Strategies (M = 3.58) ranked highest, while Academic Behaviors and Contextual Skills and Awareness were lower, both at M = 3.45. This dimensional pattern—where cognitive and content-related competencies outpace behavioral and contextual ones—is pedagogically informative. The Philippine Senior High School curriculum has been designed with substantial content coverage in mathematics and core subjects, which may explain relatively stronger content knowledge and cognitive strategy ratings. However, the comparatively lower scores on Academic Behaviors (study habits, persistence, self-monitoring) and Contextual Skills (navigating institutional systems, seeking academic support, understanding college norms) suggest a preparedness asymmetry: students arrive with sufficient disciplinary knowledge but inadequate self-regulatory practices and institutional acumen to fully leverage that knowledge in a higher education environment. This is consistent with the broader critique that Philippine K–12 reforms have prioritized content alignment over the development of metacognitive and collegiate navigation competencies (Conley, 2010).

Table 5. Students’ college readiness

Students’ College Readiness	Weighted Mean	Descriptive Value
Key Cognitive Strategies	3.58	Ready
Key Content Knowledge	3.62	Ready
Academic Behaviors	3.45	Ready
Contextual Skills and Awareness	3.45	Ready
Composite Mean	3.53	Ready

Despite their generally adequate readiness levels, college readiness did not emerge as a significant predictor of mathematics performance in the regression model ($p > .05$). This non-significant finding is theoretically expected and empirically corroborated. Conley's (2010) original framework explicitly positioned readiness as a longitudinal construct—one that shapes cumulative academic trajectories, persistence to graduation, and long-term success—rather than a predictor of performance within individual courses over a single semester. The skills captured by readiness measures (institutional navigation, help-seeking, long-range planning, and self-monitoring) manifest most clearly in behaviors that unfold across time: degree completion rates, grade-point averages over multiple semesters, and persistence through academic difficulty. Hernández et al. (2020), in a systematic review of socioeconomic status and academic performance in higher education, similarly found that readiness indicators showed attenuated predictive strength for discipline-specific performance metrics, performing more strongly as predictors of retention and progression. Zimmerman's (2002) self-regulated learning model suggests a plausible mediating pathway: readiness likely influences performance indirectly by shaping the quality of self-regulatory behaviors (goal-setting, self-monitoring, adaptive help-seeking), which in turn affect how students mobilize their cognitive capacity in the face of mathematical demands. Future research employing mediation analysis would be

valuable in unpacking whether readiness exerts indirect effects through self-efficacy or self-regulation that were not detectable through direct regression. Additionally, sample homogeneity – all participants enrolled in the same course at the same institution – likely constrained the variance in both readiness and performance, further limiting the statistical capacity to detect predictor effects (Cohen et al., 2003).

Students' Mathematics Performance

Students demonstrated high overall mathematics performance ($M = 87.14$, $SD = 3.05$), with 54.50% scoring in the 85–89 range and 16.40% achieving 90 and above (Table 6). These results reflect a positively skewed grade distribution compressed toward the upper end of the scale—a pattern consistent with the institutional grading norms of Philippine higher education, where final grades in general education courses are rarely distributed across the full range (Cohen et al., 2003). The restricted standard deviation ($SD = 3.05$) has a direct statistical implication: range restriction in the outcome variable reduces the sensitivity of regression analyses to detect predictor effects, as all predictors must explain variance within an already narrow band of scores. This means that the significant effects of academic stress and parental income identified in the hierarchical regression are, in a meaningful sense, conservative estimates. These predictors were robust enough to emerge as significant even under conditions of suppressed outcome variability. Conversely, the non-significance of AQ and college readiness should be interpreted with this constraint in mind: their effects may be present but insufficiently detectable given the statistical environment of this dataset.

Table 6. *Students' Mathematics performance*

Mathematics Performance	Frequency (n=189)	Percentage
90 – above	31	16.40%
85 – 89	103	54.50%
80 – 84	55	55%
Mean	87.14	
SD	3.05	

Differences in AQ, Academic Stress, and College Readiness Across Profile Variables

Sex emerged as the most consistently significant differentiating variable across all three constructs: AQ ($t = 45.062$, $p < .001$), academic stress ($t = 17.529$, $p < .001$), and college readiness ($t = 45.542$, $p < .001$; Tables 7–9).

Table 7. *Comparison of students' adversity quotient across profile variables*

Variables	t/f-value	p-value	Statistical Inference
Age	1.970	.120	Not Significant
Sex	45.062*	<.001	Significant
Parents' Monthly Income	2.740*	.030	Significant
Mothers' Educational Attainment	5.853*	<.001	Significant
Fathers' Educational Attainment	4.980*	.001	Significant
Course	18.145*	<.001	Significant
Specialization	8.727*	<.001	Significant

Table 8. *Comparison of the students' academic stress when grouped according to their profile variables*

Variables	t/f-value	p-value	Statistical Inference
Age	1.445	.231	Not Significant
Sex	17.529*	<.001	Significant
Parents' Monthly Income	2.381	.053	Not Significant
Mothers' Educational Attainment	4.225*	.001	Significant
Fathers' Educational Attainment	2.078	.085	Not Significant
Course	4.747*	.031	Significant
Specialization	5.103*	.002	Significant

Table 9. *Comparison of the students' college readiness when grouped according to their profile variables*

Variables	t/f-value	p-value	Statistical Inference
Age	0.753	0.522	Not Significant
Sex	45.542*	<.001	Significant
Parents' Monthly Income	2.667*	0.034	Significant
Mothers' Educational Attainment	3.941*	0.002	Significant
Fathers' Educational Attainment	4.545*	0.002	Significant
Course	18.145*	<.001	Significant
Specialization	4.591*	0.004	Significant

Male students scored significantly higher on both the AQ and college readiness, while also reporting higher academic stress. This pattern initially appears paradoxical but becomes intelligible within the socio-cognitive literature on gender and academic contexts. Males in mathematics-intensive programs may experience heightened stress not despite, but partly because of, their greater self-awareness of academic demands and stronger investment in performance outcomes. Putwain and Daly (2020) argued that societal expectations linking male identity to STEM competence can generate a performance pressure that amplifies anxiety in evaluative mathematics situations. Simultaneously, higher AQ and readiness scores among male students may reflect advantages in prior academic socialization or domain-specific confidence rather than a genuine immunity to stress. This finding also diverges from Matud's (2004) broader finding that women report higher chronic stress levels—a divergence likely attributable to the specific academic domain examined here, where gendered expectations around mathematics performance may reverse the typical pattern.

Parental income significantly differentiated AQ ($F = 2.740, p = .030$) and college readiness ($F = 2.667, p = .034$) but not academic stress ($F = 2.381, p = .053$). The first two findings align with the socioeconomic achievement gradient: higher-income families provide greater access to academic resources, tutoring, technology, and stable learning environments—inputs that build both the resilience orientations captured by AQ and the preparedness competencies measured by college readiness (OECD, 2022; Sirin, 2005). The non-significance of income for stress is notable and interpretively rich: it suggests that academic stress, at least in this sample, is not primarily a function of economic privilege but rather a universal experience of the academic transition—one that high-income and low-income students may experience with similar intensity, though potentially through different stressors (financial precarity versus performance expectations). This interpretation aligns with the transactional nature of stress: it is the perceived mismatch between demands and resources that matters, and this perception can be high regardless of material circumstances.

Mothers' educational attainment significantly differentiated all three constructs (AQ: $F = 5.853, p < .001$; stress: $F = 4.225, p = .001$; readiness: $F = 3.941, p = .002$), while fathers' attainment differentiated AQ ($F = 4.980, p = .001$) and readiness ($F = 4.545, p = .002$) but not stress ($F = 2.078, p = .085$). The stronger and broader influence of maternal education across all three constructs—including stress—is consistent with research establishing maternal education as a particularly potent predictor of children's academic socialization, likely because mothers in the Philippine context are more directly involved in children's academic lives and provide more emotional support (Davis-Kean, 2005). The fact that paternal education did not significantly differentiate stress may reflect different parental roles in academic-emotional support versus structural academic preparation. Finally, course enrollment and specialization produced significant differences across all three constructs, which are plausibly explained by self-selection: students who choose STEM-intensive specializations may arrive with more developed academic orientations, greater familiarity with demanding content, and different stress profiles than generalist or humanities-track students.

Predictors of Students' Mathematics Performance

The hierarchical regression model significantly predicted mathematics performance, $F(2, 185) = 8.10, p < .001$, with the final model explaining 8% of total variance ($R^2 = .08$; Tables 10–11). Two predictors emerged as statistically significant: academic stress ($\beta = -0.934, p = .002, \Delta R^2 = .048$) and parental income ($\beta = 0.0008, p = .012, \Delta R^2 = .032$). AQ and college readiness did not demonstrate significant direct effects after controlling for stress and socio-demographic variables.

Table 10. Summary table of the statistics for the developed regression model of students' mathematics performance

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-value	p-value
Corrected Model	139.523	2	69.762		
Residual	1611.386	185	8.710	8.099	<.001
Corrected Total	1750.910	188			

Table 11. Parameters and coefficients of the predictors in the regression model of students' mathematics performance

Predictors	R ² - Change	Regression Coefficients	Standard Error	Probability
Constant		89.216	1.083	<.001
Students' Academic Stress	0.048	-0.934	0.301	0.002
Parent's Monthly Income	0.032	0.0008	0.000	0.012

Academic stress was the strongest predictor across all four blocks. The negative regression coefficient ($\beta = -0.934$) indicates that for each one-unit increase in perceived academic stress, mathematics grades declined by approximately 0.93 points, holding all other variables constant. This finding constitutes robust empirical support for the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984): when students appraised the demands of Mathematics in the Modern World as exceeding their coping resources, the resulting stress response activated cognitive interference processes—attentional narrowing, suppression of working memory capacity, and heightened threat monitoring—that directly impaired the reasoning operations required for mathematical problem solving (Eysenck et al., 2007; Ashcraft & Krause, 2007). The incremental variance contributed by academic stress ($\Delta R^2 = .048$) is particularly meaningful given the restricted range of the outcome variable: stress explained nearly 5% of grade variance within a distribution spanning only a few points, underscoring the potency of its effect. These results extend and corroborate the broader empirical literature: Pascoe et al. (2020) established in a systematic review that stress exerts consistent deleterious effects on academic performance; Gong et al. (2023) found that academic stress predicted learning burnout even after accounting for resilience; and Caviola et al. (2022), in a meta-analysis of nearly one million participants, confirmed robust negative associations between mathematics anxiety—a core component of academic stress—and mathematics achievement across diverse educational contexts.

Parental income emerged as a secondary but statistically significant predictor ($\beta = 0.0008$, $p = .012$, $\Delta R^2 = .032$). Although the regression coefficient appears small in absolute terms, this reflects the measurement scale of the variable (raw peso values); the substantive interpretation is that students from higher-income households achieved marginally but reliably higher mathematics grades. This finding is consistent with the extensive literature establishing socioeconomic status as a structural determinant of academic achievement operating through multiple channels: access to educational resources and tutoring, nutritional and physical health, exposure to enriched home learning environments, and reduced cognitive burden from financial stress (Sirin, 2005; OECD, 2022). In the Philippine context, Budiongan and Reyes (2024) similarly documented that socioeconomic background predicted academic performance through resource access, while Casas (2023) noted that income-performance associations can vary by educational level. This caveat underscores the importance of studying this relationship within specific institutional and disciplinary contexts, as this study does. Significantly, the income effect was detectable even in a sample characterized by pervasive low income (83.59% earning below ₱10,000 monthly), suggesting that even marginal economic differences within economically disadvantaged populations carry meaningful implications for academic outcomes. This points to the compounding nature of socioeconomic disadvantage: small income differentials at the low end of the distribution may translate into disproportionately large differences in educational opportunity.

The non-significance of AQ and college readiness as direct predictors, after controlling for stress and income, is theoretically interpretable rather than null. Resilience-related constructs, as Martin and Marsh (2006, 2009) established, operate most powerfully as moderators or buffers under conditions of severe or chronic adversity rather than as direct performance drivers under normative academic conditions. In this sample—where students were generally performing well and operating within a structured institutional environment—resilience may have quietly maintained engagement and prevented dropout rather than differentiating performance levels. The conditions necessary to reveal AQ as a performance differentiator (e.g., major academic setbacks, severe disengagement risk) were likely not sufficiently present. Similarly, college readiness exerts its influence through longitudinal cumulative processes—degree progression, retention, adaptive help-seeking across multiple semesters—rather than through single-course performance (Conley, 2010; Hernández et al., 2020). A critical limitation here is the absence of self-efficacy and self-regulation as measured mediators: both AQ and readiness are theorized to influence performance indirectly through these psychological mechanisms (Zimmerman, 2002; Putwain et al., 2023), and their direct non-significance may partly reflect the suppression of indirect effects that hierarchical regression, by design, cannot fully capture. Taken together, the results empirically substantiate the layered theoretical model advanced in this study: stress appraisal functions as the proximal and dominant cognitive-performance mechanism, while AQ and college readiness operate as more distal enabling constructs whose effects are likely mediated, moderated, and temporally extended beyond what a cross-sectional single-course design can capture.

Conclusion

This study demonstrates that among AQ, academic stress, and college readiness, only academic stress and parental income directly predict mathematics performance among first-year pre-service teachers. Academic stress,

operating as a proximal cognitive-performance mechanism through working memory interference and attentional disruption, exerts a stronger direct influence on mathematics outcomes than dispositional resilience or college readiness—confirming the integrated layered theoretical model. AQ and readiness function as distal enabling constructs whose effects are likely mediated through self-efficacy and self-regulation and manifest more clearly over longer academic trajectories.

For institutional practice, these findings call for three targeted responses. First, foundational mathematics courses in teacher education should embed structured stress-management interventions—such as cognitive restructuring modules, mindfulness-based approaches, and performance anxiety workshops—as pedagogically integral components rather than optional add-ons. Second, universities should establish accessible financial and academic support systems for economically disadvantaged students, including scholarships, peer mentoring, and supplementary instructional resources, recognizing that even small income differentials within low-income populations carry meaningful academic consequences. Third, resilience-building and college readiness programs should be positioned explicitly as investments in long-term professional persistence and development, rather than as direct levers for immediate grade improvement—setting realistic expectations for their effects while sustaining their inclusion in student support frameworks.

This study is limited by its cross-sectional design, which precludes causal inference; the restricted grade distribution, which may have attenuated regression coefficients; and its single-institution scope, which limits generalizability. Future research should investigate mediation pathways (e.g., $AQ \rightarrow \text{self-efficacy} \rightarrow \text{performance}$; $\text{readiness} \rightarrow \text{self-regulation} \rightarrow \text{performance}$), incorporate domain-specific mathematics self-efficacy as a measured mechanism, and employ longitudinal or experimental designs to clarify the temporal dynamics among resilience, stress, readiness, and achievement across the teacher education trajectory.

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