Math Anxiety and Academic Dishonesty in the STEM Academic Track

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ABSTRACT

This study examines the relationship between mathematics anxiety and cheating tendencies among Science, Technology, Engineering, and Mathematics (STEM) students at the University of the Visayas-Dalaguete Campus. A total of 75 respondents were surveyed, with a nearly balanced gender distribution and a predominance of 18-19-year-old Grade 12 students. The findings reveal that the overall level of mathematics anxiety is moderate, with high anxiety levels observed during tests and homework assignments. Regarding cheating tendencies, students generally agreed with statements regarding the acceptability and prevalence of cheating behaviors, with a mean score categorized as "Agree." A Pearson correlation analysis was conducted to explore the relationship between mathematics anxiety and cheating tendencies, revealing a weak positive correlation ($r = 0.144$) and a non-significant p-value (0.219), indicating no significant relationship between the two variables. This suggests that math anxiety does not directly lead to cheating behaviors among students. The study draws on General Strain Theory, highlighting the role of negative emotions in crime but finding no direct connection between anxiety and cheating in this context. The study's limitations include a narrow focus on STEM students and mathematics-related contexts, suggesting future research should broaden the sample and examine other contributing factors.

Keywords: math anxiety, cheating tendencies, STEM students, mathematics performance, student behavior

INTRODUCTION

Mathematics continues to be a cornerstone and a stumbling block in the realm of STEM education. Many students encounter not only intellectual challenges but also intense emotional responses as they interact with abstract equations, intricate formulas, and algorithmic thinking. Mathematics anxiety is one of the most prevalent of these, a psychological phenomenon that impacts students at all academic levels. However, in STEM classrooms, a more covert but equally significant issue persists, in addition to the apparent challenge with numbers: the increasing prevalence of academic dishonesty, particularly plagiarism.

Mathematics is a fundamental discipline that is indispensable for the development of analytical thinking and quantitative reasoning, which are particularly critical in the fields of science, technology, engineering, and mathematics (STEM) (National Research Council, 2012). Nevertheless, students frequently experience feelings of overwhelm as mathematics curricula become more intricate, which can result in maladaptive coping strategies and elevated emotional responses. Math anxiety, a term originating from Richardson and Suinn (1972), is one of the most frequently observed emotional reactions. It refers to a sensation of dread, apprehension, or tension that impedes one's ability to perform mathematical operations.

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As defined by Sue et al. (2015), anxiety is a fundamental emotional response to stressors that is characterized by the activation of a "fight or flight" response and physical symptoms. This response can become chronic and debilitating in academic settings, particularly in math-related contexts. Olango (2016) and Wiedemann (2015) underscored that math anxiety is not solely an academic impediment, but a multifaceted issue that encompasses cognitive, affective, and physiological responses. Chang and Beilock (2016) emphasized that individuals with high math anxiety suffer from diminished working memory capacity during problem-solving, which has a direct effect on motivation and performance. As a result, students frequently disregard mathematics courses and related career paths, as noted by McAnallen (2010) and Buckley et al. (2016). This conduct has a cascading effect on their academic performance and professional aspirations.

A developing concern over academic integrity, particularly fraudulent behavior, is occurring concurrently with the increase in arithmetic anxiety. Cheating in academic environments is defined as any endeavor to obtain an unwarranted advantage through dishonest methods (Wilkinson, 2009). These behaviors encompass communicating with peers during assessments, using unauthorized materials, and duplicating answers. Davis et al. (2009) argue that academic dishonesty is not merely ethical transgression, but rather a failure of academic systems to cultivate integrity and resilience. Anderman et al. (2009) classified cheating into a variety of forms, such as the exploitation of systemic loopholes and the misuse of technology. Cizek (2012) posited that habitual cheating undermines students' self-assurance and results in superficial learning, rendering them unprepared for real-world challenges.

Although educational research has investigated both math anxiety and deception, their intersection remains largely unexplored, particularly in the high-stakes environment of STEM education. This is a critical deficiency, particularly in light of the fact that students who are experiencing excessive anxiety may turn to dishonest behaviors as a coping mechanism to maintain their academic standing or self-esteem. The Self-Determination Theory (Deci & Ryan, 1985) and other theoretical frameworks posit that students may disengage or engage in maladaptive behaviors, such as deception, when they lack autonomy, competence, or relatedness in learning environments. Furthermore, the Cognitive Load Theory (Sweller, 1988) proposes that excessive cognitive burden, such as that imposed by math anxiety, can impair working memory and problem-solving capacity, potentially driving students to take detours.

It is both imperative and opportune to determine whether math anxiety can predict deceptive tendencies. Although there is a moderate negative correlation between academic performance and math anxiety in the existing literature (Ashcraft & Krause, 2007; Foley et al., 2017), there are few studies that have investigated whether math anxiety can be used as a predictor of ethically compromised behaviors, such as plagiarism. Considering the significance of academic integrity in STEM education and the extensive consequences of compromised learning, this research aims to investigate the relationship.

Consequently, the objective of this investigation was to investigate the predictive influence of math anxiety on the propensity to deceive among senior high school students who are enrolled in the STEM academic track. In doing so, the research contributes to a more nuanced comprehension of the emotional and behavioral aspects of student learning and offers critical insights for educators, administrators, and policymakers. Additionally, the results of this investigation have the potential to influence the creation of interventions that are specifically designed to address the ethical decision-making of students within the learning environment, in addition to their academic challenges.

LITERATURE REVIEW

Mathematics Anxiety

According to Zhang et al. (2019), mathematics anxiety has a stronger negative impact on senior high school students compared to other grade levels. Similarly, Mohamed and Tarmizi (2010) found that higher levels of mathematics anxiety were more prevalent in senior high students than in junior high students. In the Philippines, Estanto (2017) studied the low academic performance in Pre-calculus among STEM students in Sorsogon and identified mathematics anxiety as a significant contributing factor. Empirical research consistently demonstrates a negative relationship between math anxiety and performance, suggesting that math

anxiety leads to poor performance in math-related tasks (Bandalos et al., 1995; Ashcraft & Kirk, 2001; Ashcraft, 2002; Cates & Rhymer, 2003; Ma & Xu, 2004; Bichsel, 2004).

Additionally, studies by Ho et al. (2000), Osborne (2001), and Yuksel & Sahin (2008) indicate no significant gender differences in the math anxiety-achievement link, despite previous research showing higher levels of math anxiety in females compared to males. Overall, math anxiety is influenced by multiple factors, beginning with a child's or adult's psychological understanding. Further research is needed to understand the underlying causes of math anxiety, especially as educational demands continue to grow. Proper interventions are essential to help individuals with math anxiety thrive and engage fully in mathematical learning.

Cheating Tendencies

Studies reveal that 60% to 90% of secondary school or university students engage in cheating (McCabe & Trevino, 1997; Schab, 1991; Whitley, 1998). Most research treats academic dishonesty as a single entity, although some distinguish between different types of cheating. For instance, Newstead et al. (1996) found differences between exam and homework cheating, while Calabrese & Cochran (1990) and Eisenberg (2004) distinguished between active and passive cheating. Factor analysis of the cheating scale revealed two types of cheating: active cheating, aimed at boosting one's own performance, and second-party cheating, aimed at assisting others (Morris, Xu, & Finnegan, 2018).

The rise of technology has also facilitated cheating, with students using online resources or purchasing papers (Davis et al., 2018). Batane (2010) found that using Turnitin at the University of Botswana reduced plagiarism when students were aware their assignments would be checked. McCabe et al. (2012) highlighted that students' attitudes toward cheating and academic integrity strongly influence cheating behavior. Those who perceive cheating as acceptable or have lower levels of moral reasoning are more likely to cheat.

Mathematics Anxiety and Cheating Tendencies

Limited research has explored the relationship between math anxiety and cheating tendencies. Cizek and Burg (2006) found a positive correlation between math anxiety and cheating behavior in high school students, particularly among those concerned about their grades and who perceived their teachers as unfair. Similarly, Pekrun, Bieg, et al. (2010) reported that math anxiety was related to increased cheating behavior in college students, mediated by achievement goals such as the desire for good grades.

These studies suggest that math anxiety and cheating behaviors are influenced by multiple factors. Strategies to reduce cheating and promote academic integrity include fostering a culture of honesty, providing support for academic skills, and implementing effective interventions. Understanding the relationship between math anxiety and cheating is crucial, and further research is needed to explore the underlying mechanisms and mitigating factors.

Statement of the Problem

The purpose of the study is to assess the relationship between mathematics anxiety and cheating tendencies of the Science, Technology, Engineering, and Mathematics students at the University of the Visayas-Dalaguete Campus for the school year 2023-2024.

Specifically, this study seeks to answer the following questions:

1. What is the profile of the respondents according to:

    1.1 Age

    1.2 Gender

    1.3 Year Level

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2. What is the extent of the student's anxiety in mathematics?

3. What is the extent of the students' cheating tendencies in mathematics examinations?

4. Is there a significant relationship between the following: Math Anxiety & Cheating Tendencies?

5. What intervention plan can be proposed based on the findings of the study?

METHODOLOGY

Study Participants

The study was conducted with a total population of 156 STEM students at the University of the Visayas-Dalaguete Campus, comprising 48 Grade 11 students and 108 Grade 12 students. To determine an appropriate sample size, the researchers utilized the Krejcie and Morgan (1970) table, which provides guidelines for sample size determination based on the total population and desired confidence level. The study ultimately included 75 respondents, selected from the entire STEM student population. The focus of the study included demographic factors such as age, sex, and year level.

Research Instrument

This study utilized two adapted survey questionnaires to assess math anxiety and cheating tendencies among STEM students. The first tool, the Achievement Anxiety Test, includes 24 Likert-scale items initially developed by Alpert and Haber (1960). It is structured in two parts: Part A gathers demographic information, such as age, gender, and year level, while Part B evaluates math anxiety through 24 statements, rated from Very High Anxiety (VHA) to No Anxiety (NA).

The second tool, the Attitude Towards Cheating Scale, consists of 34 statements designed by Gardner and Melvin (1998). This scale measures cheating tendencies with statements rated on a scale ranging from Strongly Agree (SA) to Strongly Disagree (SO), with intermediate options including Agree (A), Undecided (U), and Disagree (D).

Data Analysis

This study used a descriptive-correlational design to examine the relationship between math anxiety and cheating tendencies among STEM students. Descriptive statistics, including means and standard deviations, were used to summarize the data, while frequency distributions highlighted the prevalence of various levels of math anxiety and cheating tendencies.

Pearson's correlation coefficient was utilized to assess the strength and direction of the relationship between math anxiety and cheating tendencies. Additionally, a correlation matrix was employed to explore how these variables were related to other factors. Simple linear regression analysis was conducted to determine whether math anxiety could predict cheating tendencies, with model fit evaluated using R-squared values.

Significance testing involved p-values to assess the statistical significance of the correlations and regression results, while confidence intervals provided a range for the true values. The analysis aimed to reveal the strength and direction of the relationship between math anxiety and cheating tendencies, recognizing that correlational studies do not establish causation. Results were interpreted with consideration of sample-specific characteristics and their potential impact on generalizability.

The study was conducted to describe and examine the relationship between math anxiety and cheating tendencies among STEM students. The study employed a correlational design. Specifically, descriptive-correlational studies assessed the variables and the relationships that occurred naturally between and among them. Descriptive correlational design was used in research studies that aimed to provide static pictures of situations as well as establish the relationship between different variables (McBurney & White, 2009).

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RESULT

Table 1 Demographic Profile

Gender	Frequency	Percentage
Male	38	50.7
Female	37	49.3
Total	75	100.0
Age Grouped		
16-17	25	33.3
18-19	40	53.3
20-21	8	10.7
22-23	2	2.7
Total	75	100.0
Year Level		
Grade 11	17	22.7
Grade 12	58	77.3
Total	**75**	**100.0**

Table 1 delineates the demographic characteristics of the respondents, classified by gender, age group, and academic year level. The gender distribution is almost equal, with males constituting 50.7% (n = 38) and females accounting for 49.3% (n = 37) of the sample. This fair allocation facilitates gender-representative insights into the topic being examined. The predominant age group among respondents is 18–19 years (53.3%), followed by those aged 16–17 (33.3%). A little fraction belongs to the elder age categories, with 10.7% aged 20–21 and 2.7% aged 22–23, signifying that the participants are primarily younger learners, aligning with the anticipated age of senior high school students (DepEd, 2016). Concerning academic levels, 77.3% of the participants are in Grade 12, and 22.7% are in Grade 11. This indicates that a greater number of responses were collected from students in their final year of senior high school, who likely possess a more comprehensive academic background and exposure to mathematics-related stress and academic pressure.

Table 2 Extent of Respondents' Mathematics Anxiety

Indicators	**Mean**	**Standard Deviations**	**Interpretation**
1. Studying for a math test	2.960	1.0835	Moderate Anxiety
2. Taking an exam (quiz) in a math course	3.160	1.1745	Moderate Anxiety
3. Taking an exam (final) in a math course	3.453	1.1542	High Anxiety
4. Picking up math textbook	2.840	1.1513	Moderate Anxiety

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5. Being given homework assignments	3.107	1.1691	High Anxiety
6. Thinking about an upcoming math test 1 week before.	3.107	1.1339	High Anxiety
7. Thinking about an upcoming math test 1 day before.	3.253	1.1401	High Anxiety
8. Thinking about an upcoming math test 1 hour before.	3.440	1.2329	High Anxiety
9. A certain number of math classes to fulfill requirements.	3.040	1.1676	Moderate Anxiety
10. Picking up math textbook to begin a difficult reading assignment.	2.973	1.2189	Moderate Anxiety
11. Receiving your final math grade in the portal/ class card.	3.173	1.3292	High Anxiety
12. Opening a math or a stat book and seeing a page full of problems.	3.267	1.1663	High Anxiety
13. Getting ready to study math test.	3.093	1.0676	Moderate Anxiety
14. Being given a “pop” quiz in a math class.	3.200	1.1740	Moderate Anxiety
15. Reading a cash register receipt after your purchase.	2.907	1.0926	Moderate Anxiety
16. Given a set numerical problem	3.013	1.1911	Moderate Anxiety
17. Being given a set of subtraction problems to solve.	3.000	1.2302	Moderate Anxiety
18. Being given a set of multiplication problems to solve.	2.960	1.2886	Moderate Anxiety
19. Being given a set of division problems to solve.	2.907	1.2322	Moderate Anxiety
20. Buying a math textbook.	2.760	1.1606	Moderate Anxiety
21. Watching a teacher work on an algebraic equation on the board.	2.987	1.1682	Moderate Anxiety
22. Signing up/ enrolling for a math subject.	3.147	1.0991	High Anxiety
23. Listening to another student explain a math formula or a problem.	2.973	1.1147	Moderate Anxiety
24. Walking into math class.	2.867	1.2118	Moderate Anxiety
Overall Mathematics Anxiety:	**2.951**	**1.1730**	**Moderate Anxiety**

Descriptive Equivalent

4.21 – 5.00 –Very High Anxiety

3.41 – 4.20 – High Anxiety

2.61 – 3.40 – Moderate Anxiety

1.81 – 2.60 – Less Anxiety

1.00 – 1.80 – No Anxiety

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Table 2 delineates the degree of mathematics anxiety among the respondents according to 24 indicators. The average score is 2.951, categorizing it as "Moderate Anxiety" according to the specified interpretive scale. The indications revealed the highest levels of anxiety in "Taking a final exam in a math course" (M = 3.453), "Contemplating an impending math test one hour prior" (M = 3.440), and "Receiving one's final math grade" (M = 3.173), all categorized as "High Anxiety." These findings corroborate prior research demonstrating that evaluative contexts, such as examinations or grade notifications, frequently elicit increased anxiety among students (Ashcraft & Moore, 2009). In contrast, reduced anxiety levels were observed in typical activities such as "Purchasing a math textbook" (M = 2.760) and "Entering math class" (M = 2.867), although they remain within the moderate range. The occurrence of moderate to high anxiety levels indicates that mathematics remains a significant source of emotional distress for several learners, especially in assessment and problem-solving situations (Ramirez, Gunderson, Levine, & Beilock, 2013).

Table 3 Extent of Respondent's Cheating Tendencies

Indicators	Mean	Standard Deviation	Interpretation
1. If during a test one student is looking at another student's answer	3.560	.9189	Agree
2. If a teacher sees a student cheating	3.440	.8580	Agree
3. Cheating on college tests is morally wrong.	3.747	.9313	Agree
4. If during a test two students are looking at each other's answer	3.360	1.0480	Undecided
5. Some sororities and fraternities keep files of old tests	3.387	.8988	Undecided
6. Only the student knows whether he or she was cheating	3.280	.9803	Undecided
7. If a student says that he or she did not cheat	3.440	.8580	Agree
8. If a term paper includes a series of exact statements from a book	3.280	.9803	Undecided
9. It is cheating to ask another student	3.413	.8557	Agree
10. If a student is offered a copy of a stolen test	3.573	.9325	Agree
11. If a student is caught cheating	3.293	.9267	Agree
12. When a student who denies cheating is found guilty	3.387	.8366	Agree
13. If a student accused of cheating admits having cheated	3.347	.9655	Agree
14. A student who hands in a purchased term paper	3.173	.9060	Agree
15. If a teacher leaves the room during a test	3.213	.9627	Agree
16. Most students who don't cheat are just afraid of getting caught.	3.427	1.0023	Agree
17. All tests should be open book because in real life	3.347	1.0066	Agree
18. A student who sees another student cheating	3.213	.9197	Agree
19. If over half the class is cheating on an assignment	3.360	.9951	Agree

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20. Students should report by name anyone seen cheating.	3.453	.9048	Agree
21. Students are justified in cheating if the teacher's grading system	3.453	.9486	Agree
22. Studying usually doesn't result in a better grade.	3.013	1.0331	Undecided
23. Most students who cheat unethical people	3.227	.9383	Agree
24. Making up an excuse to withdraw from a course	3.080	.9831	Undecided
25. Smart students make good grades without really having to study.	3.187	1.1113	Agree
26. The whole purpose of going to college is to get a degree.	3.453	.9486	Agree
27. Students who cheat don't learn as much as others.	3.253	1.0410	Agree
28. There is really nothing wrong with cheating	3.307	1.1147	Agree
29. If a student accidentally sees an answer on someone's paper	3.253	.9739	Agree
30. Testing and grading are just a game with the students on one side	3.307	.9001	Agree
31. College tests don't measure useful knowledge or ability.	3.253	1.0792	Agree
32. Most students who are accused of cheating are innocent.	3.267	.9772	Agree
33. Most college students never cheat.	2.987	1.0331	Undecided
34. It is lying when a student who cheated denies it.	3.427	.9469	Agree
Overall Cheating Tendencies:	**3.328**	**0.962**	**Agree**

Descriptive Equivalent

4.21 – 5.00 –Strongly Agree

3.41 – 4.20 – Agree

2.61 – 3.40 – Undecided

1.81 – 2.60 – Disagree

1.00 – 1.80 – Strongly Disagree

Table 3 depicts the respondents' inclinations on academic dishonesty as determined by 34 statements. The average score is 3.328, falling into the "Agree" category, indicating a general acceptance or recognition of cheating actions and rationalizations in academic contexts. The greatest mean (M = 3.747) was recorded for the statement "Cheating on college tests is morally wrong," signifying that students intellectually acknowledge the unethicality of cheating, notwithstanding other responses indicating leniency. Conversely, the lowest mean (M = 2.987) corresponded to the assertion "Most college students never cheat," reflecting a degree of suspicion among respondents about the integrity of their peers. Numerous additional items are categorized as "Undecided," indicating ambiguity in students' ethical positions regarding cheating or the potential normalization of such behavior within academic culture (McCabe, Treviño, & Butterfield, 2001). The findings underscore the intricacy of students' views on academic dishonesty, shaped by contextual elements like peer conduct, institutional ethos, and success-related pressures (Rettinger & Kramer, 2009).

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Table 4 Correlation Result Between the Respondents' Mathematics Anxiety (MA) and Cheating Tendency (CT)

Variables	R	P	Decision	Interpretation
MA ▼ CT	0.144	0.219	Reject Ho	Not Significant

Table 4 illustrates the relationship between mathematics anxiety and cheating inclinations using Pearson's correlation coefficient. The calculated r-value is 0.144, indicating a weak positive correlation between the two variables. The p-value of 0.219 signifies that this correlation lacks statistical significance at the standard alpha level of 0.05. Consequently, the null hypothesis is upheld, indicating that there is no significant correlation between math anxiety levels and cheating behavior among STEM students. This discovery challenges previous assumptions that increased academic anxiety may lead students to engage in dishonest academic behaviors as a coping strategy (Cizek, 1999; Anderman & Murdock, 2007). It can be deduced that although anxiety may be present, it does not inherently result in academic dishonesty among the respondents in this context, potentially due to ingrained academic values or robust institutional policies on academic integrity.

DISCUSSION

Summary of Findings

The analysis of mathematics anxiety levels showed that respondents generally experienced moderate anxiety, with particular peaks during evaluative situations such as final exams, receiving grades, and anticipating upcoming tests. Meanwhile, cheating tendencies among the respondents were generally moderate to high, with many agreeing that cheating is morally wrong, yet acknowledging situations where they or others might justify it. Despite these observations, statistical analysis revealed no significant correlation between mathematics anxiety and cheating tendencies, as indicated by the Pearson r-value of 0.144 and a p-value of 0.219.

CONCLUSION

The findings of the study indicate that while both mathematics anxiety and cheating tendencies are present among STEM students, they appear to function independently. Students may feel anxious about mathematics without necessarily engaging in academic dishonesty, suggesting that anxiety alone may not be a sufficient predictor of cheating behavior. This contradicts common assumptions that higher anxiety would lead to a greater likelihood of cheating as a coping mechanism. The data supports the notion that academic integrity is influenced by a broader set of variables, such as personal values, school policies, and peer culture, rather than solely by emotional or psychological distress caused by specific subjects like mathematics.

Implications

The results of this study have several implications for educators, administrators, and guidance counselors. First, the presence of moderate to high math anxiety indicates a need for instructional strategies that can reduce fear and stress in mathematics learning environments. Teachers may consider incorporating more supportive, confidence-building activities and formative assessments to reduce anxiety. Second, the prevalence of cheating tendencies despite moral recognition of dishonesty suggests that students might benefit from clearer institutional communication about academic integrity policies, along with the implementation of honor codes or character-building programs. Lastly, the absence of a significant correlation between anxiety and cheating calls for a multifaceted approach to academic support, one that addresses emotional well-being, ethical development, and effective learning strategies separately.

Limitations

Several limitations must be acknowledged in this study. The sample was limited to STEM students from a single senior high school campus, which may limit the generalizability of the findings to students in other strands or institutions. Additionally, the study relied on self-reported data, which is susceptible to social

desirability bias—students may have underreported their cheating behaviors or overstated their levels of anxiety. Furthermore, the cross-sectional design of the study does not allow for causal conclusions; it can only identify associations between variables at a single point in time.

Future Research Directions

Future studies may benefit from exploring this topic using a larger and more diverse sample that includes students from other academic strands and campuses. A longitudinal approach may also be adopted to examine how math anxiety and cheating tendencies develop and interact over time. Moreover, qualitative investigations—such as interviews or focus groups—could provide deeper insight into students' motivations, coping mechanisms, and the contextual factors influencing academic dishonesty. Future researchers may also examine other potential mediators or moderators between anxiety and cheating, such as academic pressure, teacher behavior, peer influence, or students' perceptions of fairness in the academic system.

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