International Journal of Open-Access, Interdisciplinary & New Educational Discoveries of ETCOR Educational Research Center (iJOINED ETCOR)

ETCOR Educational Research Center Inc.
SEC Reg. No. 2024020137294-00
Sta. Ana, Pampanga, Philippines
Website: https://etcor.org

iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577

The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Mathematics Anxiety: Effects on Grade 9 Mathematics Performance

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Received: 22 January 2024 **Revised**: 25 February 2024 **Accepted**: 26 February 2024

Available Online: 26 February 2024

Volume III (2024), Issue 1, P-ISSN – 2984-7567; E-ISSN - 2945-3577

Abstract

Aim: This study sought to determine the relationship between mathematics anxiety and the performance of Sacred Heart School – Hijas de Jesus' Grade 9 students in Mathematics.

Methodology: This was a descriptive research using a correlational analysis between mathematics anxiety and the Mathematics performance. The mathematics anxiety level was determined by the Abbreviated Mathematics Anxiety Rating Scale. After taking the test, a group of five students was chosen in each section as the respondents of the Focus Group Discussions. A correlational design was employed to look into the results of the variables involved.

Results: These were the findings of the study: (1) In mathematics test anxiety, the students were categorized as Moderately Anxious. For numerical task and mathematics course, the students were Less Anxious. As a whole, the students were Moderately Anxious, (2) In mathematics test anxiety, both female and male students were Moderately Anxious. For numerical task anxiety, the female students were Less Anxious while the male students had Not at All. For the mathematics course, both female and male students were Less Anxious. As a whole, the students were Moderately Anxious, (3) The level of anxiety of the females and males did not differ, in terms of mathematics test anxiety, numerical task anxiety, mathematics course anxiety, and as a whole, (4) The students, both female and male, were categorized as Satisfactory in terms of Mathematics performance, and (5) There was a substantial and significant negative correlation between mathematics anxiety and academic performance in mathematics.

Conclusion: It was concluded that mathematics anxiety is a potential predictor of students' performance in mathematics. The students with high anxiety performed low in the subject and conversely. The Debilitating Anxiety Model which suggests that a child's performance in Mathematics is linked to his or her anxiety towards the subject and the Reciprocal Theory which articulates that anxiety and performance is a vicious cycle wherein higher anxiety contributes to poor performance and poor performance contributes to higher anxiety were both affirmed in this study.

Keywords: anxiety, self-efficacy, mathematics performance

INTRODUCTION

Mathematics has always had a reputation for being a difficult subject despite its application to real-world scenarios. Many kinds of research have been conducted to make learning mathematics life-long and enjoyable. In the Philippines, teachers undergo training to learn strategies for teaching mathematics concepts. The K-12 educational reform which started in 2012 was designed to create a high-performing and inclusive school education system as well as to produce students who are globally competitive (Sarvi et. al, 2015). In spite of these interventions, there are still students who do not perform well on the subject.

The task and weight of the responsibility to develop students' knowledge of the subject lie in mathematics teachers, hence professional development opportunities are provided. However, at some point, many teachers seldom take the time to know well their clientele. A teacher must not stop at knowing varied strategies but must also know his or her students well in terms of their strengths and weaknesses to accommodate their needs better.

An indicator of a student's weakness is a negative emotional reaction to the subject. This is mathematics anxiety, which has been defined as a feeling of pressure and nervousness that restricts students from the manipulation

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of numbers and solving of mathematical problems from simple scenarios like identifying if the change is accurate, to the complicated ones like solving quadratic functions (Center for Neuroscience in Education, 2017).

Some sources of mathematics anxiety are unproductive tension among students, timed tests, and risk of public embarrassment. Negative experiences at school and at home can be transferred which then cause lack of understanding of mathematics (Phillips, 2017).

It is therefore necessary to know the relationship, between mathematics anxiety among students and their performance in mathematics. Knowing the relationship could aid in establishing strategies to improve our students' performance in mathematics in all grade levels, hence this study.

This study was anchored on the Debilitating Anxiety Model, the Reciprocal Theory and Albert Bandura's Social Cognitive Theory and Self-Efficacy Theory. The Debilitating Anxiety Model and the Reciprocal Theory dwell on causal directions between mathematics anxiety and poor mathematics performance, whereas Bandura focuses on how academic performance is influenced by thought processes, interaction of the environment and the belief of a person's capabilities.

The Debilitating Anxiety model suggests that the link between mathematics anxiety and mathematics performance is driven by anxiety's devastating consequences on learning and recalling mathematics skills. Mathematics anxiety reduces mathematics performance by causing avoidance of mathematics-related situations and cognitive interference. Meanwhile, The Reciprocal Theory suggests that the relationship between mathematics anxiety and mathematics performance operates in both directions, higher anxiety contributes to poor performance, and poor performance contributes to higher anxiety, then a feedback loop is created (Carey et. al, 2014).

Social Cognitive Theory (SCT) started as the Social Learning Theory (SLT) in the 1960s. It theorizes that learning occurs in a social context with a dynamic and reciprocal interaction of the person, environment, and behavior. The unique feature of SCT is the emphasis on social influence and its emphasis on external and internal social reinforcement. The theory takes into account a person's past experiences, which factor into whether a behavioral action will occur (LaMorte, 2016).

Self -efficacy refers to beliefs in one's capabilities to organize and execute the courses of action required to manage prospective situations. The basic principle behind Self-efficacy Theory is that individuals are more likely to engage in activities for which they have high self-efficacy and less likely to engage in those they do not (Positive Psychology Program, 2018).

The preceding theories focused on the academic performance of students and how the environment affects their manner of processing information, how the students respond to it, and the belief in his/her capabilities.

The following provides an overview of articles on mathematics anxiety which includes its indications, who are affected, its causes, how it is measured, its significance in the academic performance of the students in Mathematics and the differences of skills of the two genders. It also contains the general performance in the National Career Assessment Examination of the grade 9 students in Sacred Heart School – Hijas de Jesus.

Mathematics anxiety is defined as a feeling of pressure and nervousness that restricts students from the manipulation of numbers and solving of mathematical problems in a wide variety of real life and academic examples. It can cause one to forget and lose one's self-confidence. Indications of mathematics anxiety range from a feeling of slight tension to experiences of a strong fear of the subject (Pradeep, 2011; Beilock and Willingham, 2014; Center for Neuroscience in Education, 2017). It must not be assumed as a condition of having poor mathematics skills but as a condition without which students would be better at Mathematics (Beilock and Willingham, 2014).

Mathematics anxiety is subdivided into three categories namely: Mathematics Test Anxiety (MTA), Numerical Task Anxiety (NTA) and Mathematics Course Anxiety (MCA). Robinson (2009, as mentioned by Karjanto & Young, 2011) described Mathematics Test Anxiety as a symptom or an emotion related with nerve-wracking situations, a fearful feeling and uneasiness that goes with cognitive difficulties during a test. Numerical Task Anxiety is the anxiety due to the basic mathematics activities. Mathematics Course Anxiety comprises the reactions of the students being in a mathematics class.

Shi and Liu (2016) state one cause of mathematics anxiety is the act of having worrying intrusive thoughts. These thoughts compete for processing resources, hence limiting their working memory.

Some causes of negativity towards mathematics are the bad experiences of mathematics courses from the students. Students who were often not confident in their understanding of basic concepts and did not see the everyday relevance or value of mathematics have bad memories of school mathematics that continued to influence how they feel about mathematics throughout their adult lives. It is also a comprehensive learning process, wherein what is used one day is used to the next and so forth (Woods, 2017).

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Phillips (2017) confirms that pressure of timed tests and risks of public embarrassment have long been recognized as sources of unproductive tension among many students.

Another factor that affects mathematics anxiety is Self-efficacy, which Bandura (1977) defines as an individual's belief in his/her capacity to execute behaviors necessary to produce specific performance attainments. It reflects confidence in the ability to exert control over one's own motivation, behavior and social environment.

Many assessment tools can help determine the academic performance, as well as the profile of Junior high school students. Among these is the National Career Assessment Examination which determines the strengths and weaknesses of the students in different career fields. From the report generated by the Student Development Center of Sacred Heart School – Hijas de Jesus, the Grade 9 students of SY 2017-2018 had a general percentile rank of 88 which is described as Above Average (NCAE Summary of Results, 2017).

Numerous studies and researches have been conducted to identify the relationship of mathematics anxiety and the academic performance of the students in Mathematics.

In 2016, Acharya explored the adversities faced by public school students in learning mathematics. In his study, some respondents argued that negative explanation about mathematics from the teacher's side, parents and other people created friction and anxiety in their readiness to learn in a meaningful way. Mathematical anxiety, lack of interest and negative feeling towards mathematics made learning mathematics difficult.

Karjanto and Young (2011) studied the undergraduate students enrolled in an Engineering program in University of Nottingham Malaysia Campus. Their finding revealed that there was no significant correlation between the level of test anxiety and students' academic performance. They found out that test anxiety was strongly related to students' expectation and females had higher mathematics-test anxiety than the male students.

Mata et. al (2012) discovered that students held positive attitudes towards mathematics. Girls showed a continuous decline in attitudes, the further they progressed in school.

There is also a notion that men are better at mathematics than women. Ameer and Singh (2013) found that male students obtained significantly higher scores in the numeracy test than the female students across First and Second year secondary students, which might be due to the fact that male students used more of spatial thinking to solve numeracy test visually as compared to the female students.

Researchers found that women had greater anxiety during a mathematics test, which taxed their working memory and led them to underperform on the test. (Devine et. al., 2012; American Psychology Association, 2017)

Beilock and Willingham's study (2014) indicated parent involvement as a factor in mathematics education. His study revealed the fact that parent involvement may be an effective way for parents and teachers to communicate (National Numeracy of UK, 2017).

In the analysis done by Aabed et.al (2016) on the Abbreviated Mathematics Anxiety Rating Scale, students were most anxious about taking a final exam, receiving their final grade, and thinking about a test one hour beforehand, which all of these are under the Mathematics Test subscale.

Reyes & Castillo (2014) sought out to determine the relationship of the performance of the students in Algebra and Trigonometry and their test anxiety. Most of the respondents felt that they needed to prepare for the Mathematics test more than in other subjects. The mathematics test anxiety affected their performance in Trigonometry. Similar result was evident in Estonanto's study (2017) which concluded that mathematics anxiety had a negative effect on the academic performance of students in Pre-calculus.

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Conceptual-Theoretical Framework

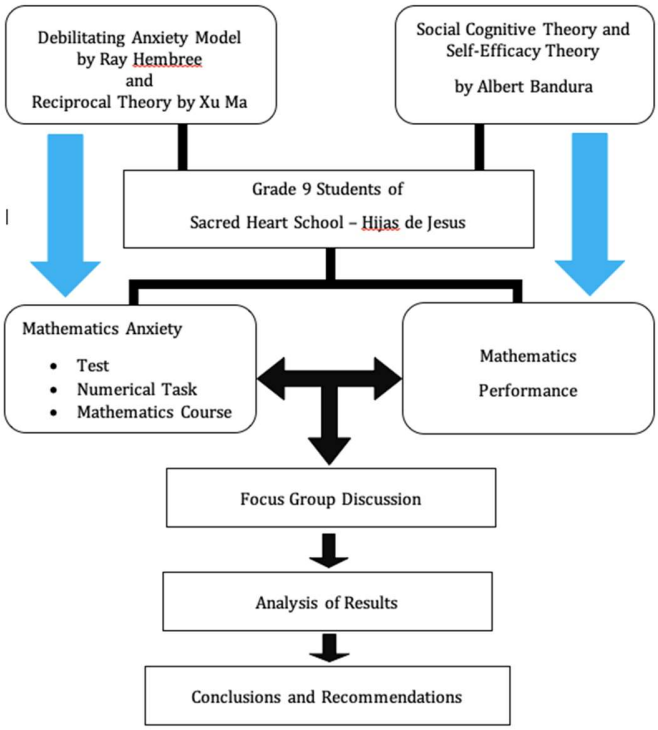

Figure 1. Schematic Diagram of the Conceptual-Theoretical Framework of the Study

As shown in Figure 1, the Debilitating Anxiety Model, the Reciprocal Theory and Albert Bandura's Social Cognitive Theory and Self-Efficacy Theory guided the process of the study. The Debilitating Anxiety Model and the Reciprocal Theory were the basis for the directional causes of mathematics anxiety. Hembree's Debilitating Anxiety Model suggests that people with mathematics anxiety are less willing to engage with mathematical tasks at all and people with mathematics anxiety have the tendency to avoid mathematics, which has a negative impact on both learning opportunities and recall in tests. Ma's Reciprocal Theory states that mathematics anxiety might cause decreased performance and poorer performance might elicit mathematics anxiety. The two theories namely Social Cognitive Theory and Self-Efficacy Theory, were the basis for analyzing the academic performance of the students in mathematics. Albert Bandura's Social Cognitive Theory states that learning occurs in a social context with a dynamic and reciprocal interaction of the person, environment, and behavior with an emphasis on social influence and external and internal social reinforcement. Another theory by Bandura is the Self-efficacy Theory which states that individuals are more likely to engage in activities for which they have high self-efficacy and less likely to engage in those they do not. This study sought to determine if there is a correlation between mathematics anxiety and the academic performance in Mathematics of the students in Sacred Heart School – Hijas de Jesus.

The students' anxiety was identified through the Abbreviated Mathematics Rating Scale (by Alexander and Martray, 1989). A focus group discussion was held with selected students to discuss factors contributing to mathematics anxiety. The results were collected, analyzed and interpreted. From these findings, conclusions and recommendations were developed. The findings of this study was presented to the faculty of Sacred Heart School – Hijas de Jesus for the school to develop a system to help lessen the anxiety of the students in mathematics learning.

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Objectives

This study aimed to determine the relationship between mathematics anxiety and the performance in Mathematics of Sacred Heart School – Hijas de Jesus Junior High School Grade 9 students.

Specifically, it aimed to look into the following:

1. What is the level of mathematics anxiety of the students in terms of
   - 1.1 Mathematics Test Anxiety;
   - 1.2 Numerical Task Anxiety;
   - 1.3 Mathematics Course Anxiety; and
   - 1.4 as a whole?
2. What is the level of mathematics anxiety of the male and female students in terms of
   - 2.1 Mathematics Test Anxiety;
   - 2.2 Numerical Task Anxiety;
   - 2.3 Mathematics Course Anxiety; and
   - 2.4 as a whole?
3. Is there a significant difference of the Mathematics anxiety level between the male and female students in terms of
   - 3.1 Mathematics Test Anxiety;
   - 3.2 Numerical Task Anxiety;
   - 3.3 Mathematics course Anxiety; and
   - 3.4 as a whole?
4. What is the level of academic performance in mathematics of the Grade Nine students of the
   - 4.1 Male students;
   - 4.2 Female students; and
   - 4.3 as a whole?
5. Is there a significant relationship between students' Mathematics anxiety and their academic performance in Mathematics?

Hypotheses

These were the hypotheses of the study:

Ho_1: There is no significant difference in the level of mathematics anxiety among female and male students in terms of:
- 1.1 Mathematics Test Anxiety,
- 1.2 Numerical Task Anxiety,
- 1.3 Mathematics course Anxiety,
- 1.4 as a whole.

Ho_2: There is no significant correlation between student's mathematics anxiety and their academic performance in mathematics.

METHODS

Research Design

This was a descriptive research using a correlational analysis between mathematics anxiety and the Mathematics performance of the Grade 9 students of the Sacred Heart School – Hijas de Jesus of SY 2017-2018. These students were assessed on their anxiety towards mathematics. After taking the test, a group of five students was chosen in each section as the respondents of the Focus Group Discussions.

Research Environment

The research study took place in the Sacred Heart School – Hijas de Jesus (commonly known as Sacred Heart School for Girls), Camputhaw, Cebu City. This is a co-educational institution with male and female faculty that aims to enrich the Christian faith and Marian devotion of the educative community where Mary's virtues of simplicity, humility, and magnanimity are lived.

The Sacred Heart School – Hijas de Jesus nourishes the pupils' and students' total being through formative and academic activities which will help them experience and live the gospel values of love, service, truth, and excellence. Some crucial features of the school's system of education are the Catholic Life Formation as the basis for the curriculum of the other disciplines, specifically, the Values Integration and conducting of dialogues to the students. In this way,

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the teacher and the student can establish communication that goes beyond the typical classroom discussion, wherein students can express openly their experiences and concerns to the corresponding subject teacher, and homeroom adviser as well.

Research Respondents

The respondents were the Grade 9 students of Sacred Heart School – Hijas de Jesus, aging from 14-16 years old. This grade level had a population of 115 students, with four sections comprising 28-29 students per class. There were 46 male students and 69 female students. In this study, the research chose 102 students as the sample since four male students and nine female students were absent during the day the survey was conducted.

Research Instrument

Mathematics anxiety can be determined through questionnaires. According to Aabeed et al (2016), the three most widely used shortened scales are the Abbreviated Mathematics Anxiety Rating Scale (AMARS; Alexander & Martray, 1989), the Mathematics Anxiety Questionnaire (MAQ; Wigfield & Meece, 1988), and the Mathematics Anxiety Scale (MAS; Fennema & Sherman, 1976). The AMARS contains three subscales: Mathematics Test Anxiety subscale, Mathematics Course Anxiety subscale, and Numerical Task Anxiety subscale. It contains 25-items with a shared 5-point rating scale: Not at All, A Little, A Fair Amount, Much, and Very Much. Eden et. al. (2013) indicated that the AMARS tried to provide a convenient means of assessment available at no cost. For the AMARS, a factor analysis revealed a three-factor structure, individually labeled as mathematics test anxiety, numerical test anxiety and math course anxiety. A two-week test-retest analysis revealed a reliability of .86. The correlation with the original MARS is .97. Although items refer to rather advanced mathematical concepts, AMARS can also be used at a high school-level.

In this study, the main instrument was the Abbreviated Mathematics Anxiety Rating Scale (by Alexander and Martray 1989), which was chosen because of its length, fit with the research question, appropriateness for the group and strong psychometric information. The original AMARS was used with minor modifications to fit the Philippine context. The modified AMARS was a 25-item, five-point Likert-type of an instrument. It had three sub-scales: Mathematics Test Anxiety (items 1-15); Numerical Test Anxiety (items 16-20) and Mathematics Course Anxiety (items 21-25). The AMARS rating forms and a set of questions in the Focused Group Discussion were used in the study. These questions asked for the students' specific experiences, causes and how they managed mathematics anxiety to further identify factors that contribute to mathematics anxiety. An agreement to use the AMARS survey and to modify it was received from its author.

The academic performance of the students in mathematics was their numerical grade in Grade 9 Mathematics for the Second Grading Period of SY 2017-2018.

Data Gathering Procedure

The researcher sent a letter to the Representative of the Hijas de Jesus Congregation to the Apostolic Center of Sacred-Heart School Hijas de Jesus through the Principal of the Sacred Heart School – Hijas de Jesus, requesting to conduct the study with the Grade 9 students (See Appendix A). As soon as the request was approved, the researcher discussed with the Mathematics Coordinator of the Junior High School Department the dates on when these were to be implemented.

The students took the Abbreviated Mathematics Rating Scale, followed by the Focus Group Discussion to get a deeper understanding of the possible factors or causes of mathematics anxiety among these students.

Statistical Treatment of Data

This study analyzed and interpreted the results using the following statistical tools and were set at 5% level of significance.

1. t-test of mean difference – this statistical treatment compared the means of the male and female students who took the Revised Mathematics Anxiety Rating Scale.
2. Pearson Product Moment Correlation – this statistical treatment measured the relationship between two variables, in particular, mathematics anxiety and their academic performance in Mathematics 9.

Ethical Considerations

The researcher ensured that all research protocols involving ethics in research were complied with for the protection of all people and institutions involved in this study.

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RESULTS AND DISCUSSIONS

Mathematics Anxiety Level of the Grade 9 Students

The mathematics anxiety level of the Grade 9 students was obtained from the modified Abbreviated Mathematics Anxiety Rating Scale (AMARS) administered to them.

Table 1 presented the students' anxiety level in terms of mathematics test anxiety, numerical task anxiety and mathematics course anxiety.

Table 1. Mathematics Anxiety Level of the Grade 9 Students

Classification	*n*	Mean	*SD*	Qualitative Description*
Mathematics Test Anxiety	102	3.14	1.02	Moderately Anxious
Numerical Task Anxiety	102	1.82	0.92	Less Anxious
Mathematics Course Anxiety	102	2.19	0.85	Less Anxious
Overall	102	2.66	0.80	Moderately Anxious

*4.21-5.00 Most Anxious
3.41-4.20 More Anxious
2.61-3.40 Moderately Anxious
1.81-2.60 Less Anxious
1.00-1.80 Not at All

Table 1 showed that the students' mean anxiety was 3.14 (SD=1.02) in mathematics test anxiety; 1.82 (SD=0.92) in numerical task anxiety and 2.19 (SD=0.85) in mathematics course anxiety. Among the three classifications of mathematics anxiety, the mathematics test anxiety subscale had the highest mean which was categorized as Moderately Anxious. This was followed by mathematics course anxiety and numerical task anxiety which were both categorized as Less Anxious. As a whole, the students were categorized as being Moderately Anxious.

Having Less to Moderate levels of anxiety meant that the students had controllable to endurable levels of anxiety. Based on the interview data, the students had their own strategies to overcome their anxiety. These were *studying harder* and *practicing more*. *Asking help from their classmates and peers* was also a coping strategy, as well was *watching instructional videos on Youtube.* "I try to change my attitude towards the subject." one student added.

This higher level of anxiety in Mathematics test quantitatively could probably be attributed to the fact when students think of having a test in mathematics, they became anxious. During the interview, the respondents indicated that their *past experiences*, the most common of which was *the pressure from their parents to get good grades* caused them to be anxious. This was followed by *how they perceive the level of difficulty of the topic.* The *manner of explanation done by the teacher, as well as their peers,* and *being surrounded by students who can easily understand the topics in mathematics* also caused them to be anxious.

The higher level of anxiety in Mathematics test supported Aabed's analysis on the Abbreviated Mathematics Rating Scale, wherein students are more anxious in situations that involve tests or assessments in Mathematics. Furthermore, this finding supported Acharya's (2016) and Mata et.al's (2012) studies of which parents, teachers and peers played an important role in controlling the feeling towards Mathematics.

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Mathematics Anxiety Level of the Female and Male Grade 9 Students

An analysis was done to identify the male and female students' anxiety level in terms of mathematics test anxiety, numerical task anxiety and mathematics course anxiety. The results were presented in Table 2.

Table 2. Mathematics Anxiety Level of the Grade 9 Male and Female Students

Classification	Gender	n	Mean	*SD*	Qualitative Description*
Mathematics Test Anxiety	Female	60	3.25	0.87	Moderately Anxious
	Male	42	2.97	1.21	Moderately Anxious
Numerical Task Anxiety	Female	60	1.87	1.0	Less Anxious
	Male	42	1.74	0.80	Not at All
Mathematics Course Anxiety	Female	60	2.24	0.89	Less Anxious
	Male	42	2.13	0.81	Less Anxious
As a whole	Female	60	2.72	0.76	Less Anxious
	Male	42	2.49	0.82	Less Anxious

*4.21-5.00 Most Anxious
3.41-4.20 More Anxious
2.61-3.40 Moderately Anxious
1.81-2.60 Less Anxious
1.00-1.80 Not at All

From Table 2, it showed that the female students' mean anxiety was 3.25 (SD=0.87) in mathematics test anxiety; 1.87 (SD=1.0) in numerical task anxiety and 2.24 (SD=0.89) in mathematics course anxiety. Meanwhile, the male students' mean anxiety was 2.97 (SD=1.21) in mathematics test anxiety; 1.74 (SD=0.80) in numerical task anxiety and 2.13 (SD=0.81) in mathematics course anxiety.

In mathematics test anxiety, both female and male students were categorized as Moderately Anxious. For numerical task anxiety, the female students were Less Anxious while the male students had Not at All. For the mathematics course, both female and male students were Less Anxious. As a whole, the students were Moderately Anxious.

Based on the data, both female and male students had comparable levels of anxiety in mathematics test, which was Moderately Anxious, in mathematics course, which was Less Anxious, but they differed in the level of anxiety related to numerical tasks. The female students Less Anxious while the male students had **Not At All**. This was probably because boys have more spatial awareness which was why generally they excel in numeracy compared to girls who excel more in reading because of their higher verbal recall skills. As a whole, both Less Anxious. This meant that both female and male students had controllable to endurable levels of anxiety.

However, the results in numerical task anxiety supported Ameer and Singh's (2013) study which indicated that male students were better at numeracy than female students across First and Second year secondary students, which might be due to the fact that male students used more of spatial thinking to solve numeracy test visually as compared to the female students.

Comparison of Mathematics Anxiety Level of the Female and Male Grade 9 Students

The mathematics anxiety of the female and male students were analyzed and the results obtained were shown in Table 3.

Table 3. Differences Between the Female and Male Grade 9 Students in Terms of their Mathematics Anxiety

Classi-fication	Gender	n	Mean	*SD*	Differences between Means	Test Statistics		
						Computed t	Tabled Value $\alpha = 0.05$	p –value
MTA	Females	60	3.25	0.87	0.28	1.284^{ns}	1.984	0.202109^{ns}
	Males	42	2.97	1.21				

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NTA	Females	60	1.87	1.0	0.13	0.728^{ns}	1.984	0.468315^{ns}
	Males	42	1.74	0.80				
MCA	Females	60	2.24	0.89	0.11	0.648^{ns}	1.984	0.51847^{ns}
	Males	42	2.13	0.81				
As a whole	Females	60	2.72	0.76	0.23	1.437^{ns}	1.984	0.15384^{ns}
	Males	42	2.49	0.76				

^{ns} Not Significant

Table 3 revealed that a difference of 0.28, 0.13, 0.11 and 0.23 in mathematics test anxiety (MTA), numerical task anxiety (NTA), mathematics course anxiety (MCA) and as a whole respectively between the female and male students. The computed t-values of 1.284, 0.728, 0.648 and 1.437 were less than the tabled value of 1.984 at 100 degrees of freedom. The p-values were greater than $\alpha = 0.05$. These test and p-values were not significant, hence failed to reject HO_1. This meant that the level of anxiety of the females and males did not differ, in terms of mathematics test anxiety, numerical task anxiety, mathematics course anxiety, and as a whole. Quantitatively, both sexes manifested comparable anxiety level in Mathematics.

This finding contradicted Devine et.al (2012) study wherein mathematics anxiety was higher for girls due to how females and males were socialized in terms of mathematics, that it is a subject of the male domain, and so females tend to avoid it. However, among those who were interviewed, both females and males indicated intrapersonal and social factors. For the intrapersonal factor, if the strategy used by the teacher did not suit the student, it was a factor for anxiety. For social factors, it was the parents. One student said "I know my parents are paying expensively for my school, so I have to get good grades." Another student added, "When I was in elementary, my mother would pressure me to get good grades."

Performance Level of the Grade 9 Students in Mathematics

Table 4 presented the students' level of academic performance in Mathematics for the Second Grading Period.

Table 4. Level of Academic Performance of the Grade 9 students in Mathematics

Gender	*n*	Mean	*SD*	Qualitative Description*
Female	60	89.33	5.98	Satisfactory
Male	42	86.45	6.78	Satisfactory
As a whole	102	88.15	6.45	Satisfactory

*95-100	Outstanding	75-84	Fairly Satisfactory
90-94	Very Satisfactory	70-74	Did not meet expectations
85-89	Satisfactory		

Table 4 showed that the female students' mean academic performance was 89.33 (SD=5.98) while the male students had a mean academic performance of 86.45 (SD6.78). As a whole, the Grade 9 students had a mean academic performance of 88.15 (SD=6.45). The Grade 9 students (both female and male and as a whole) were categorized as Satisfactory in academic performance. This satisfactory performance of the students meant that they performed way above the passing criterion set by the Department of Education. The Grade 9 students might have learned well most of the concepts taught resulting in their having a Satisfactory performance. Based on the interview conducted in this grading period which dealt on Algebra and Geometry, Geometry took up more than half of the meetings of this subject, particularly on proving statements about segments and angles. One student identified proving statements about segments and angles as difficult since it involves comprehension and analysis of statements presented. However, the results of their assessments in Algebra compensated for their low performance in Geometry since the lessons in Algebra involve procedures that were given to the students that dealt on how to solve problems, thus giving them as a whole, a satisfactory performance.

Comparing the results of similar satisfactory performance of females and males supported Devine et. al (2012) which found no difference between boys and girls in Mathematics performance. The satisfactory performance was also in consonance with the results of their National Career Assessment Examination, of which the students had an Above Average Rating percentile rank description.

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E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Relationship Between Students' Mathematics Anxiety and their Performance in the Subject

To establish relationship between the students' mathematics anxiety and their academic performance in mathematics, the Pearson Product-Moment Coefficient of correlation, r was computed. The results were presented in Table 5.

Table 5. Correlation Between Students' Mathematics Anxiety and their Performance in the Subject

Variables	Mean	SD	Test Statistics		
			r-value	Computed t-value	p-value
Mathematics Anxiety	2.66	0.80	-0.55^* (substantial)	-6.59^*	0.0001^*
Mathematics Performance	88.15	0.45			

*significant at $\alpha = 0.05$

Table 5 showed the computed r (-0.55) and t (-6.59). This was supported by a p-value of 0.0001 which was less than $\alpha = 0.05$, hence significant. Ho_2 was rejected which meant there was a substantial and significant negative correlation between students' mathematics anxiety level and their Mathematics performance. Students who manifested high anxiety in Mathematics performed low in the subject. Conversely, students who had low mathematics anxiety had high performance in mathematics. This meant that anxiety is a potential predictor of students' performance in in the subject. This may imply that if students were more pressured and nervous, it restricted them or they became more afraid to solve problems thus, getting low performance in the subject. This supported the study of Estonanto (2017) and Reyes & Castillo (2011) which revealed that mathematics anxiety and performance had a significant relationship.

The findings of this study concurred with the Debilitating Anxiety Model which suggested that there is a link-between mathematics anxiety and mathematics performance and the Reciprocal Theory which articulated that anxiety and performance is a vicious cycle wherein higher anxiety contributes to poor performance and poor performance contributes to higher anxiety.

The following findings were derived from the study:

1. In mathematics test anxiety, the students were categorized as Moderately Anxious. For numerical task and mathematics course, the students were Less Anxious. As a whole, the students were Moderately Anxious.
2. In mathematics test anxiety, both female and male students were Moderately Anxious. For numerical task anxiety, the female students were Less Anxious while the male students had Not at All. For the mathematics course, both female and male students were Less Anxious. As a whole, the students were Moderately Anxious.
3. The level of anxiety of the females and males did not differ, in terms of mathematics test anxiety, numerical task anxiety, mathematics course anxiety, and as a whole.
4. The students, both female and male, were categorized as Satisfactory in terms of Mathematics performance.
5. There was a substantial and significant negative correlation between mathematics anxiety and academic performance in mathematics.

Conclusions

Learning Mathematics would not be smooth for the students if they had negative attitudes towards certain tasks. Negative attitudes translate to mathematics anxiety which comprises feelings of pressure and nervousness that restricts students from the manipulation of numbers and solving mathematical problems. As such, it is important that parents, teachers, the students' peers and the students themselves create a more positive and confident culture around Mathematics in order to see positive impact on skills in the subject.

Based on the findings of the study, mathematics anxiety is a potential predictor of students' performance in mathematics. The students with high anxiety performed low in the subject and conversely. The Debilitating Anxiety Model which suggests that a child's performance in Mathematics is linked to his or her anxiety towards the subject, and the Reciprocal Theory which articulates that anxiety and performance is a vicious cycle wherein higher the anxiety contributes to poor performance and poor performance contributes to higher anxiety, were both affirmed in this study.

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Recommendations

Based on the findings and conclusions of the study, the following recommendations were suggested:

1. that Mathematics teachers facilitate instruction and assessments in a non-threatening way;
2. that dialogues with parents to discuss concerns of students especially on concerns that involve pressure from the parents be held;
3. that the anxiety level and academic performance be identified in every grading period of the school year;
4. that further studies in other grade levels and on anxiety towards different areas in Mathematics like Algebra, Geometry, Trigonometry, Statistics, and Calculus be undertaken.

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