ETCOR Educational Research Center PHILIPPINES
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 Test Anxiety and Numerical Anxiety as Predictors of Achievement in Mathematics

Frederick A. Inoncillo
Baliuag University, Philippines
Corresponding Author email: fainoncillo@gmail.com

Received: 24 December 2023 **Revised**: 12 February 2024 **Accepted**: 14 February 2024

Available Online: 14 February 2024

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

Abstract

Aim: The main objective of the study was to explore the two dimensions of mathematics anxiety which are mathematics test anxiety and numerical anxiety as to whether they predict Mathematics achievement in terms of content areas and cognitive areas as measured by Center for Educational Measurement (CEM) Achievement Test.
Methodology The researcher made use of descriptive-quantitative design with questionnaire as the main instrument of gathering the data. A total of 97 high school respondents were chosen using convenience sampling.
Results: Results revealed that students manifest different intensities of mathematics test anxiety and numerical anxiety based on the following levels: very low, low, moderate high and very high. In addition, there is also a significant negative relationship between the mathematics test anxiety and mathematics achievement (r=-0.224), and numerical anxiety and mathematics achievement (r=-0.385) trough Pearson moment correlation analysis. Moreover, It was found that both mathematics test anxiety and numerical anxiety predict mathematics achievement [$F(2, 94)=8.450$, $p<0.005$] through multiple regression analysis. Furthermore, results showed that between the two dimensions of mathematics anxiety, numerical anxiety highly predicts mathematics achievement ($b=-8.710$, $p=0.001$).
Conclusion: Thus, inverse significant relationships exist between mathematics test anxiety and mathematics achievement, and numerical anxiety and mathematics achievement. Moreover, mathematics test anxiety and numerical anxiety when combined, significantly predict mathematics achievement. Furthermore, between mathematics test anxiety and numerical anxiety, it is numerical anxiety that predicts mathematics achievement when taken individually.

Keywords: mathematics test anxiety, numerical anxiety, mathematics achievement, content areas, cognitive areas

INTRODUCTION

Anxiety can cause pain for students, both with and without disabilities, when they are faced with specific academic tasks. Teachers need to be aware of the warning signs of anxiety and how it affects their students' academic performance (Dobson, 2012).

Life is made up of both positive and negative feelings. However, a lot of people suffer from extreme negative emotions like being tense, scared, nervous, worried, and anxious. All of these words allude to anxiety.

Anxiety is a common reaction to some circumstances. While a small amount of anxiety is normal, severe anxiety can pose a significant threat. Over time, academic anxiety can cause more harm. Anxiety over specific academic assignments rises when students' academic performance declines (Huberty, 2012). Anxiety related to social situations and academics can affect most teachers' students. Unwanted effects of anxiety may arise in the information processing system. Information retrieval and storage are challenging for anxious people (Nelson & Hardwood, 2011). Some students struggle greatly with mathematics due to anxiety. Not all educators are aware of the symptoms of anxiety and how it affects their pupils. Teachers can assist students in overcoming academic anxiety if they are able to recognize the symptoms.

According to Sun (2023), mathematics anxiety has long been a hotly debated topic of research in education and psychology, and studies have confirmed the prevalence of mathematics anxiety among learners of various ages

ETCOR Educational Research Center PHILIPPINES
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

and its impact on learners' mathematics performance. Similarly, the relationship between math anxiety and academic achievement has been the subject of numerous studies. Moreover, the study of Karimi and Kumar (2010) shows that math anxiety is a reliable indicator of both math performance and overall academic achievement. Furthermore, they discovered that the effects of mathematics anxiety on both math performance and overall academic performance are somewhat influenced by gender. More research on students' anxiety related to mathematics across grade levels is also necessary. It is imperative that math achievement be evaluated.

One way to gauge a student's proficiency in mathematics is by administering standardized tests. The National Achievement Test (NAT) and the Centre for Educational Measurement (CEM) Test are the two most widely administered standardized tests in the Philippines. To assess students' performance in math, science, and English, CEM is used in conjunction with NAT in private schools and certain science high schools across the nation.

CEM tests are meticulously designed, developed, and maintained. CEM has been reacting to modifications in the Department of Education's prescribed curriculum for a number of years.

Starting with the 2011–2012 academic year, the Basic Education Curriculum (BEC) was replaced by the K–12 Curriculum (under Republic Act No. 10533, also called the Enhanced Basic Education Act). CEM is now concentrating on creating exams that accurately measure students' learning competencies in the K–12 context as the K–12 Curriculum goes into effect. The exams assess abilities in a variety of content areas, including analysis, evaluation, judgement, logic and reasoning, and critical thinking. The K–12 curriculum lists these competencies. The DepEd's curriculum implementation is aligned with the Transitional K–12 Achievement Tests.

The researcher chose to focus on the two aspects of mathematics anxiety—mathematical test anxiety and numerical anxiety—and their effects on students' math achievement tests in light of these studies and observations. The purpose of the study is to ascertain whether or not students' performance in mathematics as determined by the CEM test is predicted by math anxiety.

The following stakeholders will benefit from and find this study important. The study's findings will be used as a foundation and point of reference by school administrators as they create new plans or initiatives to help students who are anxious about mathematics, particularly those who are anxious about math tests and numbers.

Teachers will receive education regarding the impact of math anxiety on students' achievement test scores. They might use this as a reminder to sharpen their instructional techniques.

They are an integral part of their kids' overall development, according to parents. Understanding the study's findings will help them see the current circumstances their kids are in and what kind of support they can offer for their benefit. The study's findings will assist parents in understanding their children's mathematical accomplishments and mathematics anxiety.

The study's findings will assist students in fully understanding their anxiety levels related to mathematics. Understanding their level of numerical anxiety and math test anxiety may help them deal with these difficulties and understand how these aspects affect their academic success.

Future researchers will learn more about the relationship between students' math achievement and math anxiety. Moreover, they will be able to build on this work to gain a deeper understanding of mathematics anxiety from two angles: test anxiety and numerical anxiety, and how these relate to mathematical success. Due to the limited research on the connections between math test anxiety and math achievement as well as between numerical anxiety and math achievement in the Philippines, this will also add to the body of literature.

Review of Related Literature

Causes and Manifestations of Math Anxiety

Mathematics anxiety is a person's negative affective reaction to an event involving numbers, math, and mathematics calculations. Moreover, Richardson and Suinn (1972) as cited in Maloney and Retinal (2020) stated that it is a feeling of tension and anxiety that hampers with the operation of numbers and the solving of mathematical problems in a wide-ranging variety of ordinary life and academic conditions. However, Shemp (1986) as cited in Alico et al., (2017) argued that moderate amount of anxiety eases academic performance.

Two primary factors are responsible for mathematics anxiety, according to a review of the literature. One is inherent, specifically the incapacity for thought. The other is extrinsic, which is the bad feeling that is transmitted from other people—like parents and teachers.

The first is anxiety due to failure of cognition. Numerous scholars have noted a connection between poor performance and mathematics anxiety (Furner & Duffy, 2002; Scarpello, 2007). In a similar vein, Wittman et al. (1998), stated that inadequate preparation for the mastery of critical skills or a failure to learn are the main causes of

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
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. Both Tooke and Leonard (1998) point out that inadequate teaching strategies that impair cognition—such as employing a traditional approach to teaching mathematics that emphasizes lecture and algorithm memorization—are to blame for mathematics anxiety.

The second is anxiety is transferred from others. According to Williams (1988) as cited in Ljiljana and Zorica (2020), instructors and the way mathematics is taught can be the source of deeply held, unfavorable beliefs. Moreover. Tobias (1993) as cited by Rossnan (2006) stated that math anxiety may also result from a bad experience with a math teacher. Similarly, Swetman (1994) notes that there is a weak relationship between the mathematics anxiety levels of their teachers and the students in the third and sixth grades. Teachers can therefore impart math anxiety to their students. Thus, it should come as no surprise that Scarpello's (2007) study found that parents' attitudes towards mathematics have a significant impact on their children's math anxiety. Therefore, mathematics anxiety can be caused by teachers' and parents' negative emotions, which can be transferred to students in math classes and at home.

Math Anxiety and Academic Achievement

The relationship between mathematics anxiety and academic performance has been the subject of numerous studies. According to Dungdung and Bangkira (2023), there is a negative correlation between mathematics anxiety and academic achievement of secondary school students. In addition, the findings of Karimi and Kumar (2010) shows that math anxiety is a reliable indicator of both math performance and overall academic achievement. Moreover, they discovered that the impact of mathematics anxiety on both mathematical performance and overall academic achievement is somewhat influenced by gender. In mathematics, women are typically more nervous than men. Furthermore, they noted that more research is required to address mathematics anxiety at various academic levels.

Ashcraft (2001) supported earlier research showing a strong correlation between math anxiety and math performance. In fact, stress-filled environments can have a negative impact on math performance, according to Beilock (2008). This is true whether people are made aware of negative stereotypes about what they should perform or find themselves in high-stakes situations where poor performance has monetary and social repercussions. However, not every person is affected in the same way. It's ironic that people with the highest potential for success when there is no pressure are also the most likely to fail in demanding circumstances.

However, other studies have also demonstrated varying perspectives on mathematics anxiety in relation to academic achievement. Specifically, research suggests that math anxiety may not always hinder the development of math skills, and that not all students will benefit from clinical interventions aimed at reducing math anxiety (Lyons & Beilock, 2012). According to the current research, students who are intrinsically motivated appear to benefit rather than suffer from mild math anxiety.

Most studies have found a negative correlation between math anxiety and performance (Ashcraft & Krause, 2007; Jameson 2013). However, some studies find no correlation at all. According to Galla and Wood (2012), people's confidence in their ability to control their emotions has a moderating effect on the relationship between mathematics anxiety and performance.

According to research on math anxiety, people who work in elementary education tend to be more anxious than other people. Math anxiety is consistently higher among pre-service education students and in-service elementary school teachers than among people in other fields (Bursal & Paznokas, 2006).

While the exact cause and mechanism of math anxiety are unknown, it is thought to be related to self-efficacy and self-concept because those who experience high levels of math anxiety also frequently have low levels of these constructs. High math anxiety sufferers have consistently been shown to have low levels of self-efficacy, or the conviction that one can successfully carry out a desired behavior to achieve a desired outcome (Cooper & Robinson, 1991; Meece, et al., 1990).

This inverse relationship makes sense because self-uncertainty brought on by anxiety makes it difficult to have faith in one's own abilities. Similarly, there is a negative correlation between math anxiety and self-concept, an ordered and multidimensional construct that encompasses both general and specific views an individual holds about himself or herself (Lee, 2009).

Ashcraft (2002) stated that students who experience math anxiety will avoid situations in which they must perform mathematical calculations. Regretfully, pupils who shun mathematics become less proficient, experienced, and trained, which increases their anxiety and leaves them ill-prepared to learn and achieve.

Although the exact causes of math anxiety are unknown, learners with higher math anxiety exhibit strong inclinations to avoid learning math, have negative attitudes towards math, and lack confidence in their ability to solve mathematical problems, according to separate studies by Ashcraft (2002) and Hembree (1988).

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Furthermore, the body of research indicates that, generally speaking, not much empirical research has been done to determine the causes of math anxiety (Geist, 2010).

Huberty (2009) stated that anxiety-related traits can influence a student's behavior, thinking, and body. High-risk exams can be particularly difficult for anxious students. It is common for students who experience anxiety to experience depression. Parents and teachers can collaborate to teach students how to manage their anxiety.

Math anxiety is frequently linked to mathematical learning disabilities (MLDs) (Kirzinger, et al., 2009). Similarly, Nelson and Hardwood (2011) compared studies on anxiety and learning disabilities in order to determine the relationship between the two. To ascertain whether or not students with learning disabilities felt higher levels of anxiety than students without learning disabilities, the effect size computations' results were employed. The correlation between anxiety levels and learning disabilities is stronger the larger the effect size. Additionally, they found that academic anxiety is substantially more common in students with learning disabilities.

Anxiety and depression increase the worry that accompanies academic tasks. Higher amounts of worry, anxiety, and depression can impair working memory and academic performance. Anxiety and depression have a major impact on school tasks that require more working memory (Owens et al., 2012). Reducing anxiety in the classroom benefits students by promoting healthy working memory.

Academic anxiety affects both typical students and students with learning disabilities. Anxiety can also afflict gifted students. Research on the effects of achievement motivation and perfectionism on gifted students was done by Fletcher and Speirs (2012). Unrealistic expectations, whether from others or from themselves, can cause perfectionist students to experience academic anxiety.

A few studies concentrate on distinct forms of perfectionism. Students who have high expectations for themselves are said to be self-prescribed perfectionists. As long as students are not too hard on themselves, self-imposed perfectionism can be beneficial. Perfectionism that is socially prescribed occurs when teachers and other adults place excessive demands on students. Perfectionism that is socially mandated is typically more harmful to students. Students who are highly concerned about meeting the expectations of others may experience anxiety problems. The exact relationship between anxiety and perfectionism has not been fully uncovered by researchers.

Lee (2009) discovered a conundrum for Korean and Japanese students. Both nations scored highly on mathematics anxiety and low on self-efficacy, despite both being among the best-performing countries. According to Morony et al. (2013), there is a similar pattern observed in many East Asian nations, including Taiwan. Students from these nations exhibit higher levels of math anxiety and lower levels of self-efficacy and self-concept, even though their achievement scores in mathematics are among the highest.

There are six recognized dimensions of mathematics anxiety, according to Kazelkis (1998). These include worry, negative affect towards mathematics, test anxiety, numerical anxiety, positive affect towards mathematics, and anxiety related to mathematics courses.

Mathematics Test Anxiety and Achievement

One aspect of math anxiety is mathematics test anxiety, which includes test preparation, administration, and response (Diaz, 2009). According to Hameed et. al (2023), undergraduates experienced high to extremely high levels of test anxiety. Moreover, they found a significant negative correlation between academic performance and test anxiety. Furthermore, test anxiety and academic achievement were found to be significantly correlated (Bhatta & Rai, 2020). This correlation is further supported by the variation in the percentage of students with test anxiety ranging from moderately high to extremely high when the division of numbers is used as a variable. Previous researchers discovered similar results. Similarly, they stated that test anxiety is one of the main issues facing students today, particularly female students, and it has a big impact on academic success. While test anxiety is lower in male students than in female students, many male students experience high levels of math anxiety.

Numerical Anxiety and Achievement

Another aspect of math test anxiety is numerical anxiety, which is related to situations in daily life when dealing with numbers is necessary (Diaz, 2009). Anxiety that arises during the process of learning mathematics is referred to as numerical anxiety. According to Nolting (2002), numerical anxiety is a feeling that arises when attempting to solve mathematical puzzles. Situations in daily life involving working with numbers and doing arithmetic calculations have been linked to numerical anxiety. Students often struggle with numerical anxiety when figuring out how much to tip for a service, for instance.

Numerical anxiety, according to Aschcraft and Krause (2007), is a state of tension, apprehension, or fear that impairs one's ability to perform mathematical tasks, such as manipulating numbers and solving mathematical puzzles

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

in both academic and real-world contexts. This is accessible to all, and it's possible that most students have it. Three main factors can be identified as the causes of numerical anxiety: environmental, situational, and dispositional. The psychological and emotional aspects of learning styles, attitudes towards mathematics, and self-concept are all covered by the dispositional factors. Students' opinions of their own aptitude for learning new subjects and performing well in mathematics are referred to as their self-concept. The environmental factors are things that affected the students before their mathematics course, like age, gender, academic major, and prior mathematics experience. The situational factors are different features that result from their specific mathematics courses: the nature of the course and how it is designed and carried out; the availability of or conversely lack of feedback: the pace of instruction, etc.

Numerous studies have demonstrated connections between anxiety and age, gender, and achievement. All grade levels have shown a negative correlation between math achievement and numerical anxiety. According to Betz (1978) as cited in Nyakudya and Nyakudya (2020), while the relationship between numerical anxiety and subpar mathematical performance is undeniably present, its exact nature and direction remain unclear.

Morada (2015) stated that male students' performance in mathematics is better than that of female students. However, there was no difference in the respondents' level of numerical anxiety across other variables. Regardless of their profile, students' level of numerical anxiety was moderate. He claimed that performance in mathematics and numerical anxiety are significantly correlated. Nonetheless, there is a weak and inverse relationship between the variables. This implies that performance decreases with increasing numerical anxiety and increases with decreasing numerical anxiety.

Anxiety and Standardized Test for Achievement

Song et al. (2023) discovered that students' math anxiety was negatively related to both standardized math achievement test scores and parent-reported math school grades. Furthermore, increased math anxiety was linked to more negative homework behaviors and less frequent participation in math-related extracurricular activities. Moreover, Kytalla (2010), outcome values (the significance of achieving well) and outcome expectancies (success or failure) influence mathematics anxiety, a prospective outcome emotion. Additionally, they imply that anxiety, a negative affective emotion, is a concern for students of all achievement levels and is probably a problem not just for those who perform poorly.

Lee (2009) investigated the connection between math anxiety, math self-efficacy, and math self-concept. Researchers looked at data on the relationship between anxiety, self-efficacy, and math self-concept in 41 different countries. For this study, information from the 2003 Programme for International Student Assessment (PISA) was examined. The outcomes differ amongst nations. According to Lee (2009), students with high math test scores tended to have a stronger math self-concept and less math anxiety in North America and Western Europe. Students with high math scores in some Asian countries tended to have low math concepts and higher math anxiety. The Programme for International Students Assessment (PISA) results indicated a strong inverse relationship between math anxiety and math scores. It's likely that students with high test scores experience less math anxiety. Overall, there was a positive relationship found between math scores and both math self-efficacy and math self-concept. Students who do well in math typically have more confidence in their mathematical aptitude.

According to Wang et al. (2015), students may learn and enjoy math more if they have a combination of high intrinsic motivation and moderate math anxiety. These results bolster efforts in math education to identify appropriate task levels for students by accounting for their math-related abilities and affect. It's possible that math anxiety does not always hinder the development of math skills, and that not all students will benefit from clinical interventions designed merely to reduce math anxiety (Lyons & Beilock, 2012). As a result, it might be preferable for some students to maintain mild levels of math anxiety. This could be achieved, perhaps, by teachers ensuring that the learning and assessment materials are somewhat difficult. Furthermore, according to several theories of cognitive interference (such as the attentional control theory and the processing efficiency theory) cited by Owens et al. (2014), high trait anxiety levels are associated with a negative impact on cognitive task performance, especially on tasks requiring a lot of cognitive resources.

However, according to Lim (2015), students' performance in mathematics is predicted to be influenced by mathematics anxiety. This result indicates that there is a positive correlation between students' achievement in mathematics and their numerical anxiety on math tests. The results of the multiple regression analysis demonstrated a linear relationship between students' achievement in mathematics and their anxiety levels related to the four basic operations, the anxiety that comes with solving challenging mathematical tasks, anxiety before and after tests, and anxiety related to answering quizzes. On the other hand, there was no discernible difference in math achievement or

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

anxiety between male and female students. According to this study, achievement in mathematics is positively correlated with test anxiety and numerical anxiety.

This outcome is consistent with the research by Yousafi et al. (2010), which found a positive correlation between math test anxiety and math achievement. This study offers proof that students' achievement in mathematics was impacted by test anxiety and numerical anxiety. Anxiety before tests was found to have a greater impact on students' math achievement than anxiety after tests; quizzes and challenging math problems are the main sources of test anxiety.

Reducing Mathematics Anxiety

According to Spikell (1993), research indicates that students learn more effectively when they are active learners as opposed to passive ones. The various methods of learning are addressed by the theory of multiple intelligences. Visual/spatial, logical/mathematical, musical, kinesthetic/body, intrapersonal and interpersonal, and verbal/linguistic learning are all covered in the lessons. Moreover, the study of Shafiq et al. (2021) showed that Cognitive Behavioral Group Therapy (CBGT) or a type of psychotherapeutic treatment that helps people learn how to identify and change the destructive or disturbing thought patterns that have a negative influence on their behavior and emotions, is highly effective in reducing math anxiety.

Theoretical framework

This study is anchored to the deficient inhibition mechanism theory. It states that worrisome thoughts are very difficult to prevent and therefore will absorb working memory and attentional resources (Hopko et. al., 1998). The assumptions of the deficient inhibition mechanism are based on two theories-namely, the inhibition theory by Hasher and Zacks (1988) and the processing efficiency theory by Eysenck and Calvo (1992). The first theory proposes general anxiety decreases in cognitive performance during the presence of disrupting stimuli. The second theory suggests that experiencing anxiety will lure on working memory capacities and therefore will compromise cognitive performance. When merging these two theories, Hopko et al. (1998) explained that lesser calculation abilities of individuals with high math anxiety are not a direct result of their worrisome thoughts but rather due to failure to withdraw attention from these thoughts. They also stated realistic evidence for the negative effect of math anxiety and its accompanying worrisome thoughts on cognitive performance.

Conceptual Framework

. This study aims to investigate the connections between math test anxiety and math achievement as well as numerical anxiety and math achievement.

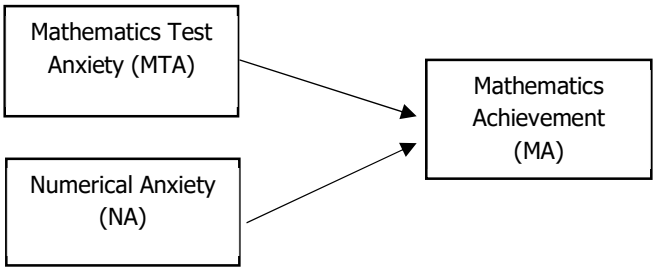

Figure 1: Conceptual Framework of the Study

The two frames on the left are the independent variables. There are the two aspects of mathematics anxiety—numerical anxiety and mathematics test anxiety. On the other hand, the frame on the right is the dependent variable. It is the Centre for Educational Measurement Test's measurement of high school students' mathematics achievement.

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Objectives

The main focus of the study is to determine the students' levels of mathematics achievement (MA), mathematics test anxiety (MTA) and numerical anxiety (NA), the relationship between mathematics test anxiety and mathematics achievement, the relationship between numerical anxiety and mathematics achievement and whether MTA and NA predict mathematics achievement.

Specifically, it aimed to answer the following research questions:

1. What is the level of mathematics achievement of Grade-7 students of Baliuag University as measured by CEM test in terms of?
    a. content area
    b. cognitive area
    c. Test Performance Indicator
2. What are the levels of mathematics test anxiety and numerical anxiety of the Grade-7 students of Baliuag University?
3. Do students who have low Mathematics Test Anxiety have higher Mathematics Achievement (MA) than those who have high Mathematics Test Anxiety?
4. Do students who have low Numerical Anxiety have high Mathematics Achievement than who have high Numerical Anxiety?
5. Is there a significant relationship between Mathematics Test Anxiety (MTA) and Mathematics Achievement (MA)?
6. Is there a significant relationship between Numerical Anxiety (NA) and Mathematics Achievement (MA)?
7. Do Mathematics Test Anxiety (MTA) and Numerical Anxiety (NA) predict Mathematics Achievement (MA)?

Hypotheses

On that note, the hypotheses are the following.

1. H_{o1}: There is no significant difference on the Mathematics Achievement (MA) among the Grade 7 students grouped according to the levels of Mathematics Test Anxiety.
2. H_{o2}: There is no significant difference on the Mathematics Achievement (MA) among the Grade 7 students grouped according to the levels of Numerical Anxiety.
3. H_{o3}: There is no significant relationship between mathematics Test Anxiety (MTA) and Mathematics Achievement (MA).
4. H_{o4}: There is no significant relationship between Numerical Anxiety (NA) and Mathematics Achievement (MA).
5. H_{o5}: Mathematics Test Anxiety (MTA) and Numerical Anxiety (NA) do not predict Mathematics Achievement (MA).

METHODS

Research Design

The study used descriptive-quantitative approach because it aimed to study if mathematics test anxiety and numerical anxiety predict Mathematics Achievement. It involved gathering of data in order to test hypotheses and to answer questions about the current status of the participants of the study. The study employed correlation, analysis of variance and regression which are very important in quantitative research.

Population and Sampling

The respondents of the study were 97 grade 7 students (comprising of 49 males and 48 females) of Baliuag University, Basic Education Department who took the Center for Educational Measurement (CEM) Achievement Test for Grade 7 during the school year 2016-2017 through convenience sampling. There were 113 students who took the CEM Achievement Test last school year. Sixteen students were not included in the study because some of them already transferred to other schools or were absent during the data gathering period. The students involved in the study are of ages 13 to 15. The reason for choosing the former Grade-7 students was that the outcome of the research may be utilized for a long time since they will still have more years to spend in Junior High School at Baliuag University. The

ETCOR Educational Research Center PHILIPPINES
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

results of the study may also be useful in monitoring the level of mathematics anxiety of the students and improving the CEM Achievement Test.

Instruments

The study focused on measuring mathematics anxiety using two primary instruments by Kazelkis (1998): the 12-item Mathematics Anxiety Scale (MAS) from Fennema and Sherman (1976) and the 25-item Revised Mathematics Anxiety Rating Scale (RMARS) developed by Alexander and Martray (1989). These scales are widely utilized for assessing math anxiety, with the RMARS chosen for its representation of the extensive MARS developed by Richardson and Suinn (1972) as cited in Kazelkis (1998). The RMARS encompasses dimensions of math test anxiety and numerical anxiety, with the inclusion of math course anxiety. The study excluded the analysis of math course anxiety, focusing solely on test anxiety in mathematics and numerical anxiety.

The reliability of the RMARS components was measured using alpha coefficients, reporting values of .96 for math test anxiety, .86 for numerical anxiety, and .84 for math course anxiety. Notably, the total scores of RMARS were highly correlated (.93) with the longer MARS version, supporting the use of the more concise RMARS. Additionally, RMARS scores showed correlations with factors such as the mother's educational background, father's occupation, and the individual's attitude toward mathematics.

Adjustments were made to the questionnaire's items (3, 4, 5, and 6) to ensure suitability for Grade 7 students in the Philippines. The modifications, guided by expert advice, involved replacing the word "course" with "class" in specific items. The questionnaire's primary objective remained unchanged despite these adjustments.

The K–12 Achievement Test, developed by the Centre for Educational Measurement (CEM), serves to assess students' academic progress in alignment with the K–12 Curriculum. The test covers major subjects in the national curriculum and provides information, combined with other assessments, to identify strengths and challenges in specific subjects and cognitive skills.

The Institutional Performance Profile (IPP) offers an overview of overall test performance for a school, presenting group performance across all sections of the test. Descriptive statistics and distribution graphs display scores, with comparisons between the school's average scaled score (ScSs) and the population's average scaled score (ScSp). A lower ScSs indicates the test was relatively harder for the school's examinees, while a higher score suggests better comprehension.

Section II introduces the Examinee Description Using Test Performance Description (TPD), and Section C displays the TPD's overall score graph, categorizing scores as Needs Improvement (NI), Moving Towards Average (MTA), Average (A), Approaching Excellence (AE), and Excellent (E).

CEM tests are designed to align with changes in the Department of Education's recommended curriculum. With the shift from the Basic Education Curriculum (BEC) to the K–12 Curriculum, CEM focuses on creating exams that measure learning competencies within the K–12 context. The assessments evaluate proficiency in essential activities such as analysis, reasoning, critical thinking, problem solving, and evaluation.

Comprehensive reports from achievement/diagnostic tests offer valuable information for parents, teachers, administrators, and students. The reports include overall scores in terms of percentile rank, standard score, percent correct, and quality index. Content area scores provide insights into students' proficiency and relative performance compared to peers.

The Mathematics K–12 Achievement Test assesses content areas such as numbers and number sense, algebra, geometry, measurement, statistics, and probability. Cognitive abilities are evaluated using the Revised Bloom's Taxonomy categories, including remembering, understanding, applying, and analyzing.

The Examinee Report (ER), Masterlist of Test Results (MTR), and Institutional Performance Profile (IPP) are fundamental reports, with additional reports like Examinee Report on Learning Competencies (ERLC), Descriptive Statistics on Test Performance, Frequency Distribution of Test Scores, and School Report on Learning Competencies (SRLC) available.

The test is continuously adapted to the evolving curriculum, and CEM strives to create exams that accurately measure students' learning competencies within the K–12 framework. The report concludes by emphasizing the utility of CEM tests for assessing student performance, providing a basis for parental monitoring, student profiles, and instructional improvement in classrooms.

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Data Collection

The Centre for Educational Measurement (CEM) results, which were obtained in February 2016 from 113 Grade 7 students at Baliuag University, were used to gauge the students' mathematical proficiency. An exam that was meant to be given in class was used for this study. An exam measuring students' levels of anxiety related to math tests and numbers was administered. At a time that worked best for the students, a single day was dedicated to administering the Revised Mathematics Anxiety Rating Scale (RMARS) survey. The questionnaire was designed with simplicity in mind to minimize potential confusion among students. The anxiety measures by Richardson and Suinn (1972), as cited in Kazelkis (1998), served as the model for the questionnaire. It is primarily used for a variety of scenarios involving groups of students who are taking mathematics as a subject and has been demonstrated and tested with a high measure of validity. With permission from the Centre for Career and Guidance Counselling, The Principal of Basic Education Department and the Vice President of Academic Affairs, the results were then examined and analyzed with the outcomes of the CEM Achievement Test in Mathematics

The researcher collected, collated, and tabulated the data for in-depth analysis. Microsoft Excel, scientific calculator and IBM SPSS (Statistical Package for Social Science) were used as necessary computing tools.

Treatment of Data

The CEM Test results and the Mathematics grades of the students were described using frequency counts and descriptive statistics. The two independent variables namely mathematics test anxiety and numerical anxiety were coded in SPSS. The students, scores in the 15-item test in MTA and in the 5-item test in NA were analyzed. Then, the students' scores in mathematics test anxiety were labelled in the following brackets of scores: Very Low (25-34), Low (35-44), Moderate (45-55) , High (56-65) and Very High (66-75). Meanwhile the scores in numerical anxiety were labelled in the following brackets of scores: Very Low (5-8), Low (9-12), Moderate (13-17), High (18-21) and Very High (22-25). For mathematics test anxiety and numerical anxiety, *Very high* was coded 5, *High* was coded 4, *Moderate* was coded 3, *Low* was coded 2, and *Very Low* was coded 1. For the Mathematics Achievement, the results of the Institutional Report Form by CEM were used.

Mean and standard deviation were used to measure the students' levels of mathematics test anxiety and numerical anxiety. In addition, skewness was used to measure of the symmetry of a distribution of data values

The correlations between mathematics test anxiety and mathematics achievement, numerical anxiety and mathematics achievement were measured using the Pearson's Product Moment Correlation through the use of SPSS. Pearson's product moment correlation is a correlation coefficient that measures linear correlation between two sets of parametric data.)

One-way analysis of variance (or one-way ANOVA) is a technique to compare whether two samples' means are significantly different. It is used to test if significant difference exist among the groups of students in terms of mathematics test anxiety and numerical anxiety were tested using the one-way

To determine if there is a significant difference among the variables, the p- value identified its significance using an F-distribution. If the p- value is below .05, then, significant difference exists. If the p- value is above .05, then, no significant difference exists.

Regression analysis is a set of statistical processes for estimating the relationships between a dependent variable and one or more independent variables. It was used to determine if mathematics test anxiety predicts mathematics achievement and if numerical anxiety predicts mathematics achievement. Multiple regression analysis was also used to know if the combined effects of mathematics test anxiety and numerical anxiety predict achievement test. Through this, the researcher was able to determine which between mathematics test anxiety and numerical anxiety highly predicts achievement in mathematics.

Ethical Considerations

To protect all individuals and institutions involved in the study's conduct, the researcher made sure that all research protocols involving ethics in research were followed. It adheres to the Data Privacy Act of 2012.

RESULTS AND DISCUSSION

The following are the data obtained from the 97 students comprising of 49 males and 48 females who took the CEM Achievement Test. They were also asked to answer the questionnaire about mathematics test anxiety and

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

numerical anxiety. The study attempted to identify if mathematics test anxiety and numerical anxiety predict mathematics' achievement.

Students' Level of Mathematics Achievement in Terms of Content Area

These are the results that show the level of mathematics achievement of the respondents in terms of content area as measured by CEM. The mean scaled scores of the respondents in the five content areas namely, numbers and number sense (NUM), geometry (GEO), measurement (MEA), algebra (ALG) and probability and statistics (PROB) were almost the same as the mean scaled scores of the entire test takers of CEM. The students' best score in the content area as compared to the population is Algebra (ALG). Meanwhile, the students' lowest mean score in the content area as compared to the population is Geometry (GEO).

Students' Level of Mathematics Achievement Test in Terms of Cognitive Area

These are the results of the level of mathematics achievement in terms of cognitive area as measured by CEM. The mean scaled scores of the respondents in four cognitive areas namely Remembering (REM), Understanding (UND), Applying (APP), and Analyzing (ANA) were almost the same as the mean scaled scores of the entire test takers of CEM. The students performed best in Understanding (UND). On the other hand, the students got the lowest mean scaled score in Remembering (REM) when compared to the mean scaled score of the population.

Students' Level of Mathematics Achievement in Terms of Test Performance Indicator

Moreover, results were gathered from the frequency distribution of the groups for test descriptions performance (TPD) of the respondents in terms of the level of CEM Achievement Test. The students are categorized based on the results of CEM Achievement Test in Mathematics namely Needs Improvement, Moving Towards Average, Approaching Excellence and Excellent. Of the 97 respondents, 12 are classified under Needs Improvement, 17 are Moving Towards Average, 46 are Average, 19 are Approaching Excellence and 3 are Excellent. This shows that majority of the students belong to the Average level. However, the distribution is positively skewed with Sk=1.336. It means that although there are many students who belong to the average level, the bulk of students who are Needs Improvement and Moving Towards Average is greater than the bulk of students who belong to Approaching Excellence and Excellent. In addition, the result of CEM Math Achievement Test has a maximum of 341 and minimum of 214 which resulted in range of 127.00 which is huge. Furthermore, the scores of the students in CEM Math Achievement test were varied and diverse in nature as can be inferred from the standard deviation of 22.2170.

Students' Levels of Mathematics Test Anxiety

The frequency, mean, and standard deviation of the mathematics achievement of the respondents who are grouped into five levels of Mathematics Test Anxiety: namely, Very Low, Low, Moderate, High and Very High. Of the 97 respondents, 2 have Very Low MTA, 22 have Low MTA, 43 have Moderate MTA, 28 have High MTA and 2 have Very High MTA. Majority of the respondents have low level of Mathematics Test anxiety. Furthermore, respondents were grouped according to their levels of Mathematics test anxiety and afterwards, their Mathematics Achievement mean scaled scores were identified. Respondents with a Very Low MTA got a mean scaled score of 222.0000, Low MTA got 259.0455, Moderate MTA got 251.8140, High MTA got 240.0714 and Very High MTA got 241.5000. This shows that the respondents from the group with Low Mathematics Test Anxiety got the highest mean scores in CEM Achievement Test in Mathematics. It is followed by the group of students with moderate amount of Mathematics Test Anxiety. It supports the studies made by Shemp (1986) that a significant amount or moderate amount of mathematics anxiety boosts academic achievement. Similarly, Lyons and Beilock (2012) stated that a particular math anxiety may not universally impair the development of math abilities and clinical efforts that simply aim to decrease math anxiety may not prove effective for all students. Therefore, it may be better for some students to keep moderate levels of math anxiety.

Students' Levels of Numerical Anxiety

Moreover, the frequency, mean, and standard deviation of the mathematics achievement of the respondents who are grouped according to five levels of numerical anxiety, namely, Very Low, Low, Moderate, High and Very High. Of the 97 respondents, 18 are Very Low, 40 are Low, 32 are Moderate, 5 are High, and 2 are Very High in terms of their levels of Numerical Anxiety (NA). This shows that majority of the respondents have low level of Mathematics test anxiety. Furthermore, the respondents were grouped according to their levels of Numerical anxiety and afterwards, their Mathematics achievement mean scaled scores were identified. Respondents with a Very Low NA got a mean

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

scaled score of 260.3333, Low NA got 252.9500, Moderate NA got 242.8438, High NA got 231.0000 and Very High NA got 249.2371. This shows that the respondents from the group with Very Low Numerical Anxiety (NA) got the highest mean scores in CEM Achievement Test in Mathematics. It is followed by the group of students with Low Mathematics Test Anxiety (NA). It supports the findings of Morada (2015) that the lower the numerical anxiety, the better or higher the performance in mathematics test. Furthermore, Lee (2009) mentioned that in the Result of Programme from International Student Assessment (PISA) in 2003 that students who got high math scores have low math anxiety. The students' scores are like patterned to the result of Northern American and European students in PISA 2003 which is contrary to the result of some East Asian students who got high math score while having high math anxiety.

Students' Comparison in Terms of Mathematics Test Anxiety

Table 1

ANOVA Table for the groups of Students in Terms of Mathematics Test Anxiety (MTA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups (Combined)	6357.723	4	1589.431	3.564	.009
CEM * MTA	41027.823	92	455.955		
Total	47385.546	96			

One way Analysis of Variance (ANOVA) was used in determining whether the scores of Mathematics Achievement of the respondents who were grouped according to their levels of Mathematics test anxiety significantly differ from each other. It was found out that the there is a significant difference among the groups of students in terms of MTA [$F(4, 92)=3.564$, $p<0.05$]. Furthermore, post hoc comparisons using the Tukey HSD test indicated that the MA mean score of students with Low MTA ($M=259.0455$, $SD=26.55897$) was significantly higher than the MA mean score of students with High MTA ($M=240.0714$, $SD=16.54607$, $p<0.05$).

The group of students with very high MTA had an MA mean of 241.5000. Meanwhile, the group with moderate MTA got 251.8140 and the group with very low MTA got 224.0000. Hembre (1990) stated that test anxiety in general routinely caused poor performance in academic achievement. However, Shemp (1986) as cited by Alico et al., (2017) stated that moderate amount of mathematics anxiety in general boosts academic achievement.

Students Comparison in Terms of Numerical Anxiety

Table 2

ANOVA Table for the Groups of Students in Terms of Numerical Anxiety

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups (Combined)	7115.428	4	1778.857	4.064	.004
CEM*NA Within Groups	40270.119	92	437.719		
Total	47385.546	96			

One way Analysis of Variance (ANOVA) was used in determining whether the scores of Mathematics achievement of the respondents who were grouped according to their levels of numerical anxiety significantly differently from each other. It was found out that there is a significant difference among the groups of students in terms of Numerical Anxiety (NA) [$F (4, 92) =4.064$, $p<0.05$]. Furthermore, post hoc comparisons using the Tukey HSD test indicated that the MA mean score of students with Very Low NA ($M=260.3333$, $SD=25.36324$) was significantly different from the MA mean score of the students with Moderate NA ($M=242.8438$, $SD=18.75153$, $p<.05$).

ETCOR Educational Research Center PHILIPPINES
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

The group with very high NA had a mean score of 223.000 in Mathematics Achievement. The group of moderate amounts of NA got 242.8438 and the group with very low NA got 260.3333 in Mathematics Achievement. It supports the study of Morada (2015) that numerical anxiety in general causes low mathematics achievement.

Relationships Between Mathematics Test Anxiety and Mathematics Achievement; and Numerical Anxiety and Mathematics Achievement

Table 3

Correlations between the Independent Variables and Mathematics Achievement.

Independent Variables	r	p
Mathematics Test Anxiety	-.224	0.028*
Numerical Anxiety	-.385	0.000**

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

The table shows that there is a very low negative correlation between Mathematics Achievement and Mathematics Test Anxiety (MTA), r = -.224, n=97, p=0.028. Bhatta (n.d.) stated that there was a significant correlation between test anxiety and academic achievement. Likewise, Hembree (1988) and Keoghi et al., (2004) stated that test anxiety is related to poor academic records. It supports the findings of Song et al. (2023) that students' math anxiety was negatively related to both standardized math achievement test scores. Furthermore, negative relationship also between numerical anxiety and mathematics achievement has been found across all grade levels (Betz, 1978) as cited in (Nyakudya and Nyakudya, 2020). On the other hand, there is a moderately low negative correlation between CEM Achievement Test in Mathematics and Numerical Anxiety, r=-0.385, n=97, p=0.000. It supports the findings of Morada (2015) that the higher the numerical anxiety, the lower the performance and the lower the numerical anxiety, the better the performance.

Predictors of Mathematics Achievement

Table 4

Regression Analysis of Predictors of CEM Achievement Test in Mathematics

	df	MS	F	p
Regression	2	3610.708	8.450	0.000
Residual	94	427.278		
Total	96			

a. Dependent Variable: CEM Achievement Test
b. Predictors: (Constant), Mathematics Test Anxiety, Numerical Anxiety

In order to determine whether the mathematics test anxiety and numerical anxiety significantly predict the CEM Achievement test in Mathematics, multiple regression analysis was used. It was found that these two when combined, reliably predict the dependent variable, CEM Achievement Test in Mathematics [F(2, 94)=8.450, p<0.005]. This means that the predictors are reliable with a significant overall F-test of 8.450, at 0.05 level of significance. It supports the findings of Karimi and Kumar (2010) that Mathematics anxiety is a good predictor of Mathematics performances and overall academic performance. Also, the result shows that between the two predictors, numerical anxiety highly predicts Mathematics Achievement.

ETCOR Educational Research Center PHILIPPINES
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

Table 5

Coefficients in Regression Analysis of Factors Predicting Mathematics Achievement

	Unstandardized Coefficient		Standard Coefficients	t	p
	B	Std. Error	Beta		
(Constant)	275.097	8.387		32.801	.000
Mathematics Test Anxiety	-1.877	2.831	-.070	-0.663	.509
Numerical Anxiety	-8.710	2.585	-0.355	3.369	.001

Results revealed that mathematics test anxiety (b=-1.877, p=0.509) does not predict Mathematics Achievement while numerical anxiety (b=-8.710, p=0.001) does when taken individually. However, as Table 11 shows, both variables Mathematics Test anxiety and numerical anxiety predict CEM Achievement Test in Mathematics when taken wholly. The table also explains that for every one unit increase of MTA, there is 1.877 decreased in the score of Mathematics Achievement as measured by CEM. Similarly, it indicates that for every one unit increase of NA there is a 8.710 decreased in Mathematics Achievement. Thus, the regression line for this research is Achievement (MA)=-1.877 MTA+-8.710 NA + 275.097.

Meanwhile, only NA was found to be predictor of Mathematics Achievement with a p=value less than .001when MTA and NA were taken individually. But in Table 11, both MTA and NA when combined significantly predict Mathematics Achievement. It supports the findings of Dungdung and Bankira (2023) that there is a negative correlation between mathematics anxiety and academic achievement of secondary school students. Furthermore, Aschcraft (2002) stated that there is a strong negative relationship between mathematics achievement and mathematics anxiety and the result supports the claim that mathematics anxiety predicts mathematics achievement.

Table 6
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.390[a]	.152	.134	20.67070

The model shows a value of R Square of .152. It means that 15.2% of the variance in the dependent variable can be predicted from the independent variables. The R-squared is quite relatively small but regression models with low R^2 can be perfectly good models. Frost (2017) stated that human behavior generally has R^2 values less than 50%. People are just harder to predict than things like physical processes. Although R squared is low, the independent variables (MTA and NA) significantly predict the dependent variable Mathematics Achievement (MA).

Conclusion

Based on the findings of this study: The following were concluded. Majority of the respondents who took the CEM Achievement Test during the school year 2016-2017 scored almost the same in content area when compared to the mean of the population. Similarly, the overall performance of the respondents in cognitive areas is almost similar when compared to the mean of the population. It is supported by the description of the mean of the students' scores based on the Test Performance Indicator TPD of CEM Achievement Test which is Moving Towards Average. Furthermore, most of the students fall under the category of Average based on the Test Performance Descriptor TPD. However, the number of students who belong to Needs Improvement and Moving Towards Average is larger than those who belong to Approaching Excellence and Excellent.

There is a significant difference in Mathematics Achievement among the groups of students in terms of Mathematics Test Anxiety (MTA). It means that students with lower Mathematics Test Anxiety got higher Mathematics Achievement. Specifically, there is a significant difference in mathematics achievement of those who have low MTA and high MTA. It means that students with low MTA got higher Mathematics Achievement than those students with high MTA.

There is a significant difference in Mathematics Achievement among the groups of students in terms of Numerical Anxiety (NA). It means that students with lower Numerical Anxiety got higher Mathematics Achievement.

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Specifically, there is a significant difference in Mathematics achievement among the students who have very low NA and moderate NA. It means that students with very low NA got higher Mathematics achievement than those with moderate NA.

There is a very low negative correlation between MTA and MA and there is a moderate negative correlation between NA and MA. Moreover, mathematics Test Anxiety and Numerical anxiety when combined predict Mathematics Achievement Test. NA highly predicts Mathematics Achievement Test.

Further research must be done to support the findings that mathematics test anxiety and numerical anxiety predict mathematics achievement. Also, more researches should be undertaken by future researchers to discover different ways to manage mathematics test anxiety and numerical anxiety as they are found to predict mathematics achievement when combined.

Recommendations

Based on the conclusion, the researcher suggested recommendations for improving students' performance in mathematics. Firstly, it suggests that math teachers and stakeholders should focus on addressing difficulties in Geometry and Measurement, as well as challenges in Remembering and Analyzing mathematics problems. It emphasizes the importance of addressing mathematics test anxiety and numerical anxiety to enhance student achievement. Secondly, it recommends creating a profile of students' mathematics test anxiety and numerical anxiety to monitor their readiness for tests like the CEM Achievement Test and assess the impact of these anxieties on mathematics achievement. The study also highlights that students with moderate and low levels of Mathematics Test Anxiety perform better, suggesting that a certain level of anxiety may be beneficial. Additionally, it notes that students with low levels of Numerical Anxiety achieve higher scores, recommending methods such as using computer software and devices to alleviate this anxiety, use cognitive behavioral group therapy and promote independent and cooperative learning. Finally, the study calls for further research to support the observed link between anxiety and mathematics achievement and encourages future research on effective strategies to manage these anxieties.

REFERENCES

Alexander, L., & Martray, C. (1989). The development of an abbreviated version of mathematics anxiety rating scale. *Measurement and Evaluation in Counseling and Development, 22*(3), 143-50

Alico, J., Maraorao, U., Maraorao, R. (2017). Personal variables and anxiety in English and Mathematics: Correlational and comparative investigation among pre-University students. *International Journal for Innovation Education and Research. 5.* 10.31686/ijier.vol5.iss11.852.

Ashcraft M.H. (2002). Math Anxiety: Personal, educational, and cognitive consequences. *SAGE Journal* Retrieved from http://journals.sagepub.com/doi/abs/10.1111/1467-8721.00196

Ashcraft, M.H. & Krause, J.A. (2007). Working memory, math performance and math anxiety . *Psychonomic Bulletin & Review 2007*, *14* (2), 243-248.

Betz, N.E. (1978). Prevalence, distribution and correlates of math anxiety in college Student. *Journal of Counseling Psychology*, *25*, 441-444

Bhatta, K., Rai, B.. (2020). Test anxiety and demographic variables affecting academic achievement among undergraduate psychology students. *International Journal of Education & Management Studies, 2020, 10(3),* 218-222

Bursal, M., & Paznokas, L. (2006). Mathematics anxiety and preservice elementary teachers' confidence to teach mathematics and science. *School Science and Mathematics, 106*, 173-180.

Cooper, S. E., & Robinson, D. A. G. (1991). The relationship of mathematics self-efficacy beliefs to mathematics anxiety and performance. *Measurement & Evaluation in Counseling & Development, 24*, 4-12.

Diaz, N. (2009). In *Math Anxiety: Causes and Cures*. Retrieved March 25, 2017 from http://thetentacle.com

ETCOR Educational Research Center PHILIPPINES
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

Dobson, C. (2012). Effects of Academic Anxiety on the Performance of Students with and without Learning Disabilities and How Students can Cope with Anxiety at School., 1-36. https://nmu.edu/education/sites/DrupalEducation/files/UserFiles/Dobson_Cassie_MP.pdf

Dungdung, P. & Bankira, S. (2023). Mathematics Anxiety and Academic Achievement of Secondary School Students in relation to their Gender and Medium of school. 28. 15-21. 10.9790/0837-2809031521.

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. Cognition and Emotion, 6, 409-434

Fennema, E., & Sherman, J.A. (1976). Fennema-Sherman mathematics attitude scale: Instruments designed to measure attitudes toward the learning of mathematics by females and males. *JAS Catalog of Selected Documents in Psychology, 6*, 31.

Fletcher, K. L., & Speirs Neumeister, K. L. (2012). Research on perfectionism and achievement motivation: Implications for gifted students. *Psychology in the Schools, 49*, 668–677.

Furner, J., & Duffy, M. L. (2002) Equality for students in the new millennium: Disabling math anxiety. *Intervention in School and Clinic, 38*(2).

Frost J. (2017). In *How high does r squared need to be?* Retrieved July 25, 2017 from https:// statisticsbyjim.com/regression/how-high-r-squared/

Geist, E. (2010). The anti-anxiety curriculum: Combating math anxiety in the classroom. *Journal of Instructional Psychology,* 37 (1), 24-31. Harter, S. & Pike, R.;1; (1984). *The Pictorial Perceived Competence Scale for Young Children. Child Development, 55*, 1969-1982.

Hameed, K., Channa, T., Khan, A., Khan, S., Rana, Mi., Gayantri, G., Arif, T., Timmer, I. (2023). Assessment of Test Anxiety and its Correlation with Academic Performance among Undergraduate Students: Assessment of Test Anxiety. Pakistan Journal of Health Sciences. 38-42. 10.54393/pjhs.v4i08.970.

Hasher, L., & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Bower (Ed.), The Psychology of Learning and Motivation, Vol. 22, 93-225. New York: Academic Press.

Hembree R. (1990). The nature, effects, and relief of mathematics Anxiety. *J Research in Mathematics Education*, *21*(1), 33–46.

Hembree (1988). Correlates, causes, effects and treatment of test anxiety. Review of Educational research, 58, 47-77.

Hopko, D. R., Ashcraft, M. H., Gute, J., Ruggiero, K. J., & Lewis, C. (1998). Mathematics anxiety and working memory: Support for the existence of a deficient inhibition mechanism. Journal of Anxiety Disorders, 12, 343-355.

Huberty, T.J. (2012). Anxiety and depression in children and adolescents: Assessment, intervention, and prevention. Springer Science + Business Media. https://doi.org/10.1007/978-1-4614-3110-7

Jameson, M.M. (2013). Contextual factors related to math anxiety in second grade children. *The Journal of Experimental Education*, 1-19

Karimi, A. & Kumar, V.G. (2010). Mathematics anxiety, mathematics performance and overall academic performance

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

in high school students. Journal of the Indian Academy of Applied Psychology. Vol.36. No. 1, 147-150. Retrieved from http://journals.sagepub.com

Kazelkis, R. (1998.). Some dimensions of mathematics Anxiety: a factor analysis across instruments. *SAGE Journal, Retrieved from h*ttp://journals.sagepub./org/10.117/0013164498058004006

Keoghi, E., Bond, F.W., French, C.C., Richards, A., & Davis, R.E (2004). Test –Anxiety, susceptibility to distraction and examination performance. *Journal of Stress, Anxiety and Coping, 17*, 241-252.

Krinzinger, Helga, Liane Kaufmann, KausWillmes (2009). Math anxiety and math ability in early primary school years. *J Psychoeduc Access. 27*(3):206-2005.

Kytalla, Bjorn (2010) Prior mathematics achievement, cognitive appraisals and anxiety as predictors of Finnish students' later mathematics performance and career orientation. *Educational Pychology.* http://tandfonline.com/doi:full/10.1080/01443411003724491

Lee, J. (2009). Universals and specifics of math self-concept, math self efficacy, and math anxiety across 41 PISA 2003 participating countries. *Learning and Individual Differences*, 19, 355-365.

Ljiljana P., Zorica G. (2020). Increasing students' motivation in mathematics teaching by applying interesting tasks in lower grades of primary school, *Zbornik radova Uciteljskog fakulteta Prizren-Leposavic*, 10.5937/zrufpl2014327P, 14, (327-336).

Lim, E. K. (2015). The influence of pre-university students' mathematics test anxiety and numerical anxiety on mathematics achievement. *International Education Studies; Vol.8, No 11*.

Lyons, I., & Beilock, S. (2012). Mathematics anxiety: Separating the math from the anxiety.*Cerebral Cortex*, 22, 2102–2110.

Maloney, E., Retanal, F. (2019). Higher math anxious people have a lower need for cognition and are less reflective in their thinking. *Acta psychologica. 202. 102939.* 10.1016/j.actpsy.2019.102939.

Marsh, H. W., & Shavelson, R. (1985). Self-concept: Its multifaceted, hierarchical structure. *Educational Psychologist, 20*, 107-123.

Meece, J. L., Wigfield, A., & Eccles, J. S. (1990). Predictors of math anxiety and its influence on young adolescents' course enrollment and performance in mathematics. *Journal of Educational Psychology, 82*, 60-70.

Morada, M. D.,(2015). Correlation of Numerical Anxiety and Mathematics Performance. *Asia Pacific Journal of Multidisciplinary Research Vol. 3. No. 5*, 45-53 from http:/www.apjmr.com

Morony, S., Kleitman, S., Lee, Y.P., & Stankov, L. (2013). Predicting Achievement: Confidence vs Self-Efficacy, Anxiety, and Self-Concept in Confucian and European Countries. International Journal of Educational Research, 58, 79-96.

Nelson, J. M., & Harwood, H. (2011). Learning disabilities and anxiety: A meta-analysis.*Journal of Learning Disabilities*, *44*(1), 3–17.

Nolting, P. D. (2002). *Winning at math: Your guide to learning mathematics through successful study skills*. Florida:Academic Success Press Inc.

Nyakudya, M. and Nyakudya, U. (2020) A Study of math anxiety in male and female students at BA ISAGO University: Empirical Evidence. *Open Journal of Social Sciences, 8*, 345-358. doi: 10.4236/jss.2020.810023.

ETCOR Educational Research Center PHILIPPINES
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

Owens, M., Stevenson, J., Hadwin, J. A., Norgate, R. (2012). Anxiety and depression in academic performance: An exploration of the mediating factors of worry and working memory. *School Psychology International, 33*, 433–449.

Owens, M., Stevenson, J., Hadwin, J. A., Norgate, R. (2014). When does anxiety help or hinder cognitive performance? The role of working memory capacity. British Journal Psychology. *105*(1): 92-101.

Richardson, F. C., & Suinn, R. M. (1972). The Mathematics Anxiety Rating Scale: Psychometric data. *Journal of Counseling Psychology, 19*, 551-554.

Rossnan, S. (2006). Overcoming math anxiety. *Mathitudes, 1(1),* pages 1 of 4

Scarpello, G. (2007). Helping students get past math anxiety. Techniques: Connecting Education and Careers, *82*(6).

Shafiq, M., Ajmal, S., Amin, R. (2021). Effectiveness of Cognitive Behavioral Group Therapy in Reducing Math Anxiety in Adolescents. Clinical and Counselling Psychology Review. 2. 10.32350/ccpr.22.04.

Shemp. R.R (1986). *The psychology of learning Mathematics*. Penguin: Harmondsworth. 95-112.

Song, S & Li, Tianyu & Quintero, Michaela & Wang, Zhe. (2023). The Link Between Math Anxiety and Math Achievement: The Role of Afterschool Learning. Journal of Numerical Cognition. 9. 418-432. 10.5964/jnc.11325.

Song, S., Li, Ti., Quintero, Mi., Wang, Z. (2023). The Link Between Math Anxiety and Math Achievement: The Role of Afterschool Learning. Journal of Numerical Cognition. 9. 418-432. 10.5964/jnc.11325.

Spikell, M. (1993). *Teaching mathematics with manipulatives: A resource of activities for the K-12 teacher*. New York: Allyn and Bacon.

Sun, R. (2023). The Effect of Mathematics Anxiety on Math Performance. Lecture Notes in Education Psychology and Public Media. 15. 133-139. 10.54254/2753-7048/15/20231045.

Swetman, D. L. (1994). Fourth-grade math: The beginning of the end? *Reading Improvement, 31*, 173-176.

Tobias, S. (1993). Overcoming math anxiety. New York: W. W. Norton & Company.

Tooke, D. J., & Leonard, C. L. (1998). Effectiveness of a mathematics method course in reducing the mathematics anxiety of preservice elementary teachers .*School Science and Mathematics*, 98(3), 136-139. Retrieved from https:// scholar.google.com.ph

Wang Z, Lukowski, S.L., Hart S. A., Lyons, I.M., Thompson L.A., Kovas, Yu, Mazzocco, M.M,.Plomin R., Petrill, S.A. (2015). Is math anxiety always bad for math learning? The role of math motivation. *Psychol Sci.*, (12), 1863-1876.

Wilder S. Ph.D, 2013. Dimensions of Mathematics Anxiety as Measured by the MARS-Brief: Factor Analysis. Retrieved February 21, 2017 from http:/interstat.statjournals.net www.statstutor .ac.uk/resources/uploaded/pearsons.pdf

Williams, V. W. (1988). Answers to questions about math anxiety. *School Science and Mathematics, 88*, 95-102.

Wittman, T. K., Marcinkiewicz, H. R., & Hamodey-Donglas, S. (1998). Computer assisted autoimmunization of multiplication facts reduces mathematics anxiety in elementary school children. *ERIC Document Reproduction Service No.* ED 423 869)

ETCOR Educational Research Center PHILIPPINES
Sta. Ana, Pampanga, Philippines
INTERNATIONAL MULTIDISCIPLINARY RESEARCH CONFERENCE
Website: https://etcor.org
iJOINED ETCOR
P - ISSN 2984-7567
E - ISSN 2945-3577
The Exigency
P - ISSN 2984-7842
E - ISSN 1908-3181

Yousefi, F., Abutalib, M., Mansoor, M. B., & Juhari, R. B. (2010). Relationship between test anxiety and academic achievement among Iranian adolescents. *Asian Social Science*, *6*(5), 100.