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The Examination of Text Anxiety, Homework Grade, Exam Grade, and Gender to Determine Course Success in Masters Students

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The Examination of Text Anxiety, Homework Grade, Exam Grade, and Gender to Determine Course Success in Masters Students

A Thesis

By

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The thesis entitled 'The Examination of Text Anxiety, Homework Grade, Exam Grade, and Gender to Determine Course Success in Masters Students' presented by Jenna Nottle, a candidate for the degree of Master of Science in Mathematics, has been approved and is worthy of acceptance.

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ABSTRACT

Anxiety is a feeling that almost every human has felt at some point in their life. Test anxiety is a branch of anxiety. Test anxiety is a combination of physical and emotional symptoms that interfere with the ability to perform well on a test. Test anxiety can causes consequences of failure, worry about the exam itself, lack confidence in one's own ability, and have low self-esteem. Studies have shown negative impact on test anxiety and test scores. A lot of this research done has been at the elementary level through undergraduate level in a students educational journey. However, not much research has been done at the masters level of a students educational journey. Since mathematics is known to be a harder subject for students due to its complexity of multistep processes to solve problems, this study focuses on masters students at Shawnee State University enrolled in the online Masters of Science Program. Data was collected from participant professors at Shawnee State University along with a survey on test anxiety. The survey that was used to collect data was the Westside Test Anxiety Scale. The purpose of this study was to understand if homework grade, exam grade, gender, and test anxiety was significant predictors of course success. Results from logistic regression showed that homework grade was a significant predictor of course success. The results of this study imply that homework grade can have a significant impact on course success and thus showing the importance of homework for students and for teachers on course success.

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Chapter 1: Introduction

Introduction

Anxiety is a feeling that almost every human has felt at some point in time. Anxiety is defined as excessive worry and apprehensive expectations, occurring more days than not for at least 6 months, about a number of events or activities, such as work or school performance (Arnold, 2022). Anxiety causes negative effects on doing tasks (Rickenberg & Reeves, 2000). These tasks can be everyday activities or more complex like work tasks and school. Along with anxiety comes a more specific form called test anxiety. Test anxiety is a combination of physical symptoms and emotional reactions that interfere with the ability to perform well on tests (Owan, V. J. , 2020). The physical symptoms of test anxiety can be seen using Sigmund Freud's theory while the emotional reactions can be seen using Hans Eysenck's theory. Test anxiety can happen in students of all ages from elementary students all the way to masters students.

Based on a study done at the University of Gondar, approximately 25-40% of US students suffer from test anxiety and approximately 13.5-71% of undergraduate college students suffer from test anxiety (Hanfesa, 2020). Test anxiety can affect an individual's ability to preform well in a course. This test anxiety can also affect social, emotional, and behavioral development and feelings about themselves and school. The social and emotion aspect of test anxiety can cause one to think about consequences of failure, worry about the examination itself, lack confidence in ones ability, and low self-esteem. The behavioral aspect can be seen by nervousness, nausea, perspiration, and tension.

More research has been done at the undergraduate level rather than the graduate level with test anxiety. Masters students can experience test anxiety with their complex examinations taken. This study provides information about test anxiety in masters students at Shawnee State University in the Masters of Science program in Mathematics. This study examines at the affects test anxiety has on passing the course while also finding the difference in gender and test anxiety.

Background of the Problem

Mathematics is known to be a challenging subject area due to its complexity of multi-step processes to solve a problem. Mathematics is a subject that also takes a lot of practice, patience, and persistence. Not being able to find a solution to the problem can be a frustrating and overwhelming aspect of mathematics. Most students struggle with mathematics. Only 7% of American students reported having a positive experience with mathematics (Furner and Duffy, 2002). The negative association of mathematics can cause a negative effect on learning mathematics. Most students tune out mathematics because of this negative association. It becomes a negative physiological aspect that students do not want to deal with. This makes mathematical testing very difficult.

Tests are an important aspect to education. Tests are given so frequently and have become a prominent role in schooling (Kohn, 2000). The purpose of tests is to measure what the student have learned or to decide where to place kids or what kind of help they need. (Kohn, 2000). Some common tests are multiple choice, true and false, fill in the blank, and short answer. Examples of problems in tests in mathematics are problems that start with the phrase “show” or “prove” or “calculate” (Zaika, et al, 2021). Proofs in

mathematics is a methods of communicating a mathematical truth to another person (Solow ,2014). Unfortunately, proofs require more work and detail (Solow, 2014). Elementary school students tend to have more frequent test such as having several test in a week. Rather than college, tests tend to become less frequent such as two a semester being a midterm and/or a final (Wright, 2002). However, these one to two exams for college students tend to be more complex. Midterms exams generally are exams based off of the first half of the course. A final exam can either be an exam on the last half of the semester or a exam of the entire semester (Wright, 2002). A student taking these math exams can experience test anxiety.

Test anxiety in mathematics can cause people to experience emotional, physical, and cognitive symptoms. Some example of these include extreme stress, discomfort, sweating, rapid heartbeat, and forgetfulness during or before taking a test (Cassidy, 2010). In a test oriented atmosphere of schools in mathematics, test anxiety can negatively affect a students performance on a test. Higher levels of test anxiety correlated with lower test results (Cassidy, 2010). These lower test results are not an accurate measure of ones true ability. The low academic achievement with test anxiety can also result in students dropping out of college (Bruno, 2015).

Theories have addressed anxiety as a whole and began to branched off into some claims on test anxiety. Research on test anxiety has been conducted on students in Elementary school. For example, Norman expanded on the existing research on high levels of test anxiety and students experience. This study found that the relationship with growth mindset and test anxiety was negatively correlated; this suggests that high levels of test anxiety have lower levels of growth mindset (Norman, 2021). Another study was

conducted on high school students. This study done by Paul von der Embse found that test anxiety accounts for a portion of variance in test achievement scores. This study also found that test anxiety has a negative impact on Ohio Graduation Test scores (Paul von der Embse, 2008). These studies previous noted have also used different kinds of surveys to measure test anxiety. Even though these studies did have validity and reliability on the measures used, the test anxiety scale used in these previous research is revised to fit the study specifically is a limitation to the study. A scale like the Westside Test Anxiety Scale should be used and be unmodified to provide accurate measurement of the scale being used (Driscoll, 2007). There is a gap in research since not much research been done on college students. Specifically, not much research has been done on masters students. An improved study with the examination of masters students and a different measurement scale along with its affects on gender will benefit students and educators have a better understanding of test anxiety.

Statement of the Problem

A previous study on anxiety showed that seeking perfectionism increases social anxiety in children (Risley, 2022). Another study conducted on anxiety in college students examined the recognition of facial expression of emotion and the effects of anxiety, depression, and fear of negative evaluation. This study found that higher general anxiety scores were marginally correlated with lower accuracy in identifying facial expressions of disgust (Merchak, 2013). These studies with anxiety show a negative effect that anxiety has. Another form of anxiety to be studied is test anxiety. Test anxiety studies have been conducted. However, test anxiety studies are limited. These studies on

test anxiety are limited in the fact that they can only test participants taking tests. These participants are most likely to be students. These students range from Elementary school to College/University. While there are studies done in grade school; not many studies are done at the College/University level. What's even more surprising is not many studies are done at the masters level at a College/University. This is surprising because exams taken at this level are more complex. With these complex exams, test anxiety can emerge. Test anxiety can emerge from different subjects as well. Mathematics tends to be the subject that most students struggle with (Berch & Mazzocco, 2007). Low students performance in mathematics is associated with high test anxiety (Owan, 2020). With this known fact, not many studies are conducted in the field of mathematics at the masters level. There is also a difference in gender and test anxiety. According to research done on ninth graders, compared to males, females tend to have higher levels of test anxiety (Sung & Chao, 2016). However, little research has been done to see if this is true for students at the masters level. This study seeks to investigate test anxiety at the masters level in mathematics and passing the course. This study also investigates if there is a difference with gender and test anxiety with passing the course.

Purpose of the Study

This study is a quantitative research design. There are six independent variables. The variables are gender, average homework grade, exam scores, final grade, and test anxiety level. Gender was chosen to see if there is a difference in test anxiety among gender and to see if gender and test anxiety has an effect on passing the course. Homework grade is important to get a starting point to see where the participants stand.

Average homework grade will be used as a comparative variable. This will compare if there is a difference in homework grade with exam grade and the effect on test anxiety. Exam scores are an important variable of this study since the exam score will be used to see the effect of test anxiety, gender, and average homework grade. Finally, test anxiety is the main testing variable in this study. Test anxiety was measured using the Westside Test Anxiety Scale. There is one dependent variable that is passing the course. This variable ties the research together to see if test anxiety has an affect on passing the course; along with seeing if there is a difference in gender with test anxiety and passing the course.

This study was conducted at Shawnee State University. The students participating are master students in the online Masters of Science in Mathematics program. The specific mathematics courses evaluated will be Abstract Algebra 1, Abstract Algebra 2, Advanced Linear Algebra, Regression 1, and Number Theory. More details and information on this section will be addressed in Chapter 3.

Significance of the Study

This study closes the gap of analysis in test anxiety of masters students in the field of mathematics. It provides more range in research in test anxiety in mathematics. This research provides completion of the student education journey; meaning connecting prior research done in early years of students with test anxiety to masters students with test anxiety. This study helps with understanding the impact test anxiety has on masters students in mathematics. Furthermore, students with test anxiety can struggle on exams and this can affect test success. Providing students with an understanding of the affects of

test anxiety can help them find ways to conquer their anxiety and improve their exam scores. Professors will have a better understanding of the impact of test anxiety as well. Professors will understand that student performance on exams can be affected by test anxiety. This study helps professors make the necessary adjustments needed for students with test anxiety to be able to pass the course. The College/University can help students with providing support services. The difference in gender and test anxiety provides more insight and support for the gender that needs it more. This study can lead to more investigation in the area of test anxiety. More investigation can be done to find ways to cope with test anxiety or even study different subject areas with test anxiety. The more research done on test anxiety can better help students pass course(s).

Primary Research Questions

1. Will test anxiety have a negative affect on passing the course in a master level math course at Shawnee State University?
2. Is there a is the relationship in low homework grades and test anxiety?
3. Is there a relationship with lower exam grades and test anxiety?
4. On average, do females tend to have higher test anxiety over males?
5. What is the effect of high test anxiety with final grade in the course?

Research Design

The participants in this study are students enrolled in the online Masters of Science in Mathematics at Shawnee State University (SSU). The data in this research was obtained in two ways. One way was a secondary source which are professors at Shawnee

State University. These professors instructed the courses that were being evaluated such as Advanced Linear Algebra, Regression 1, Number Theory, Abstract Algebra 1, and Abstract Algebra 2. These professors collected average homework grade, exam grades, and final grades. The other source was a survey. This survey was distributed online using google forms. This survey was based of the Westside Test Anxiety Scale (Driscoll, 2007) and had one question at the end asking the participants gender. Data collected from SSU and the survey results will be analyzed using a variety of statistical techniques. These techniques was used to identify if there is a difference in test anxiety levels, student grades, and gender. The overreaching goal of the study is to examine the relationship between test anxiety and academic performance for graduate students in a Masters of Science in Mathematics program.. Analysis will also show if gender plays a role in test anxiety. In addition, linear regression will be performed to identify factors that predict academic success of passing the course in a master class. Analysis of this data was captured using the statistical package of R (RCore Team, 2021).

Theoretical Framework

The development of anxiety along with the different kinds of anxiety were the theoretical frameworks that guided this study. A well know theorist named Sigmund Freud used his knowledge on psychology and how it creates anxiety. Freud and his psychodynamic approach to psychology says that anxiety is an unconscious conflict within the individual. These conflicts are when the ego could not control the conflict between the id and superego. The ego is the reality of the person that uses rational thinking. The id is instincts, impulses and urges. The superego is morality that

incorporated the values and morals of society that is learned (Freud & Strachey, 2013). Freud examined three types of anxiety: reality anxiety, neurotic anxiety, and moral anxiety. Reality anxiety is anxiety of day to day activities of real-world events (Freud & Strachey, 2013). For example, if someone is near a dog they might have anxiety and fear of getting bit by a dog. Neurotic anxiety is anxiety that emerges from urges, insecurities, or fears of losing control. This leads to extensive worry (Pizzarro, 2020). Some examples of neurotic anxiety is constant worry about their safety or health, guilty over things that aren't their fault, obsessive thought about situations. Moral anxiety is having anxiety of violating ones own internalized values (Freud & Strachey, 2013). An example of this is social fear; someone may find shame and guilt of trying to fit in with a specific crowd. When anxiety occurs, the mind's first response is to seek rational ways of escaping the situation. To do this, the mind needs to increase problem-solving efforts. However, a range of defense mechanisms may be triggered. Some defense mechanisms are denial, displacement, intellectualization, projection, rationalization, reaction formation, regression, repression, suppression, and undoing.

Another component to anxiety is personality. A theory by Hans Eysenck uses the theory of personality into his theory of anxiety. Eysenck theory with anxiety depends on extroversion/introversion, and neuroticism. Extroversion is when a person is interactive with other people. These types of people receive energy or stimulation from socializing with others (Eysenck, 1955). Introversion is the complete opposite. Introverts receive energy or stimulation from their own thoughts or a small group of people. According to Eysenck, extraversion was caused by a variability in cortical arousal or brain activity. Introverts have higher levels of brain activity than extraverts which is why introverts are

more cortically aroused than extraverts (Eysenck, 1955). These high levels of brain activity make introverts more prone to anxiety. Neuroticism is another part of Eysenck theory. Neuroticism is a range that Eysenck gave people that is from normal/fairly calm to nervous/quiet. Neuroticism is also split into two with high emotional stability or low emotional stability (Eysenck, 1955). High is someone who has high levels of stress or anxiety while low is the opposite. A neurotic individual is sensitive to anxiety which provokes stimuli that are based on the autonomic nervous system (Eysenck, 1955). Being anxiety prone is inherited, but anxiety can also be learned. Traumatic events lead to unconditioned fear, but can then become conditioned resulting in new stimuli producing the original anxiety responses. Anxiety is viewed as conditioned fear that is part of ones personality.

These theories can be used in the branch off of anxiety for test anxiety. Test anxiety is a combination of physical symptoms and emotional reactions that interfere with the ability to perform well on tests (Owan, V. J. , 2020). The physical symptoms of test anxiety can be seen using Freud's theory while the emotional reactions can be seen using Eysenck's theory. These physical and emotional reaction can have an impact of the students academic success. The impact could be lower exam grades resulting in lower course grades. This can even jeopardize passing the course.

Assumptions, Limitations, and Scope

This study assumed that the participants answered truthfully and accurately to the survey questions. It is assumed that the participants fully understood the survey questions being asked. Since the survey was delivered online though google forms, it is assumed

that no student had any technical glitches that would alter any survey answers. It was assumed that the participants tried their best on their exams. It was also assumed that the secondary source professor collected and sent over the correct and accurate data for the participant.

This study had no control over whether a professor gave one exam or two. Given this information, some students took the survey twice while some only took it once. Students will be answering the same survey before each exam, so the students answers on test anxiety may change dramatically from the first exam from the second exam, which is considered a limitation. Another limitation is gender may not be equally distributed per class which can have an impact on the results of the study. Results may very by the different courses since some courses are more complex than others. Another limiting factor is this study only used graduate students from one specific department at only one university. So, results from this program of graduate student may not be the same for students in another program.

The scope of this study focuses on test anxiety with masters students in the online Masters of Science in Mathematics program at SSU. Participants of this study were ages 18 and above. The duration of the study was during the Spring 1 and Spring 2 semester during the months of January 2023-April 2023. All data collection and data analysis was done online.

Data was collected only at SSU. Math was the main subject of interest. Masters students in the Master of Science in Mathematics program was the only wanted participants in this study. There was no specific types of classes wanted to be studied. The types of classes were chosen based off the professors willing to offer their students

participation on data collection. The specific survey of intent was the Westside Test Anxiety Scale which used to collect data on test anxiety. This survey provides a specific and reliable way to calculate a score for test anxiety. The online software called R was used for data analysis using logistic regression linear regression techniques.

Definition of Terms

- Anxiety is defined as excessive worry and apprehensive expectations, occurring more days than not for at least 6 months, about a number of events or activities, such as work or school performance (Arnold, 2022).
- Test anxiety is defined as tension and apprehensiveness associated with taking a test, frequently resulting in a decrease in test performance (American Psychological Association)
- Passing the course is with the grade of B or higher.
- Logistic regression estimates the probability of an event occurring based on a given dataset of independent variables
- Linear regression is a linear approach used to explain the relationship between a scalar response and one or more explanatory variables.

Summary

Chapter 1 introduced the problem statement to be investigated in this study. Background information, important details and the intended design of the study was presented. This study will further present a literature review in Chapter 2 which will go over the theories of anxiety of how they branch off into test anxiety. It will also go into

further detail of prior research and the flaws within them. The literature will be followed by the chapter 3 with methodology being used in this study with going into more detail about the survey used in this study, data collection, and data analysis. Results from this study will then be presented in chapter 4 followed by a conclusion of the study.

Chapter 2: Literature Review

Introduction

Over the past few decades, research on test anxiety has been conducted. There has been a relationship between test anxiety and student success. However, this relationship is not a positive one as seen in chapter 1. Before jumping more into the topic of test anxiety, there is more research that is needed to be known in the background. This background of test anxiety is testing environment, confidence, outside factors, online learning, and disorders contributing to test anxiety. This chapter will cover the literature of the background of test anxiety and connect the importance of this study on test anxiety in masters students.

Tests is a word that students are far too familiar with. Tests have been used in schools to assess student performance and learning, identify areas where additional support is needed for the student, and evaluate the effectiveness of teaching methods (Kohn, 2000). There are different types of tests used such as standardized test, classroom assessments, and teacher-made tests. Standardized tests are administered and scored in a consistent manner to ensure all test takers are being evaluated using the same procedures and scoring criteria. However, these standardized tests are limited in their ability to measure student learning and they do not provide accurate reflection of students' skills and knowledge (Wiggins, 2011). When students take standardized tests, they can use test-taking strategies. While these test-taking strategies may be great resource to use, it also provides a threat to actual learning. Rather than actually understanding the material, students use test-taking strategies such a guessing and memorization to answer questions.

A study was conducted that used this memorization test-taking strategy. This study found that students who took multiple choice tests after studying showed better retention of the material (Fazio et all, 2010). However, students who took a multiple choice test immediately after studying has lower long-term retention of the information (Fazio et all, 2010).

These multiple choice tests also have an impact in mathematics. Another form of tests called high-stakes tests are a type of testing where the results have a significant consequences for students. These high-stake tests are used to evaluate a students performance and make important decisions such as graduation or eligibility for certain programs. High-stakes testing has a negative impact on the learning of mathematics (Göloğlu Demir, C., & Kaplan Keleş, 2021). These high-stakes testing encourages memorization and test-taking strategies rather than deep understanding and problem solving skills (Göloğlu Demir, C., & Kaplan Keleş, 2021). High-stakes testing can create a stressful environment for students (Göloğlu Demir, C., & Kaplan Keleş, 2021). This pressure and stressful environment can impact their performance on test. Additionally, students who do not perform well on tests may feel discouraged and disengaged from mathematics (Göloğlu Demir, C., & Kaplan Keleş, 2021). It was also shown that students who reported high levels of test anxiety performed better on a multiple choice test than a short-answer test (Fazio et all, 2010). Standardized tests are also biased. These tests are biased against students of certain groups such as those from low-income backgrounds, those with disabilities, and those from non-dominant cultural backgrounds (Wiggins, 2011). These students may not have had access to the same educational opportunities as their peers. Examples of the biases are language bias, particularly with students whose

first language is not the language of the text and cultural bias which is when a question references cultural practice may be more easily understood by students from that culture rather than student who are not (Wiggins, 2011). The biases can impact the results of the test.

Confidence has an impact on students success in school. Self-confidence refers to an individual's belief in their ability to perform a specific task or achieve a particular goal (Usta, 2017). A study done in Turkey examined the relationship between TEOG scores and self-confidence; TOEG stands for transition from basic to secondary education. There is a positive relationship between TEOG scores and self-confidence (Usta, 2017). This means that students with a high TEOG score have a higher level of self-confidence. Conversely, students who struggled with this transition had a lower level of self-confidence. Motivation is also an important aspect to student success. Students who had a higher level of motivation tended to perform better on the TEOG exam (Usta, 2017). This shows that motivation is positively correlated with TEOG scores.

Self-efficacy also has an impact on student success in school. Self-efficacy is an individual's strong belief they have the capacity to perform a specific task or achieve a particular goal (Usher, 2009). Mastery experiences are a significant source of self-efficacy. Mastery experiences refer to experiences of successfully completing tasks or activities related to mathematics (Usher, 2009). Students who have a positive experience with mathematics such as solving difficult problems and getting good grades, tend to have high levels of self-efficacy in mathematics (Usher, 2009). Also, students who had a higher level of mathematics self-efficacy tended to have lower levels of difficulty in learning mathematics (Elastika et all., 2021). Furthermore, verbal confirmation for

students had an impact on self-efficacy. Students who received positive feedback and encouragement from teachers, parents, and peers reported having higher levels of self-efficacy in mathematics (Usher, 2009). Moreover, social modeling by observing others can also impact self-efficacy. Students who observed others successfully completing mathematics tasks or activities tended to have higher levels of self-efficacy in mathematics (Usher, 2009). Finally, emotional and physiological states such as anxiety and stress also have an impact of self-efficacy. Students who experienced negative emotions or physiological responses with tasks or activities in mathematics have a lower level of self-efficacy (Usher, 2009). This can negatively impact a students success in mathematics.

Students who have a higher proficiency in mathematics tended to have a more positive attitude toward mathematics (Cerbito,2020). This also means that students that have a low proficiency in mathematics tend to have a negative attitude toward mathematics. The negative attitude toward mathematics can cause students to struggle in mathematics. However, male students tend to have a more positive attitudes toward mathematics compared to female students (Cerbito,2020). The gender difference in the attitude in mathematics can have an impact of student achievement in mathematics. Students that have more positive attitudes toward mathematics tend to be more motivated to learn and more engaged in classroom activities (Cerbito,2020). It is also known that a teacher plays an important role in students attitude toward mathematics. Students who had a positive experience with their mathematics teacher had a more positive attitude toward mathematics (Cerbito,2020). Furthermore, teacher quality plays a role in student success. The quality of teaching and the learning environment in schools can significantly

impact academic performance (Mushtag & Khan, 2012). Students who perceive their teachers to be effective and a positive learning environment tend to perform better academically (Mushtag & Khan, 2012). A positive interaction with a student and their teacher can have a positive impact on student academic success. Teaching strategies can also impact student success. Effective teaching strategies such as active and inactive learning and the use of real-life examples and problem solving tasks were found to be associated with lower levels of student difficulty in learning mathematics (Elastika et all., 2021). Feedback from teachers can also impact student success. Negative feedback is used to help student identify the areas that need improvement. This negative feedback highlight mistakes or where a student fell short in their performance (Malonley et all, 2013). Negative feedback causes students to interpret this feedback as evidence for the inability to perform well in mathematics. However, negative feedback can increase math anxiety and can lead to poor performance (Malonley et all., 2013). It is important to be aware of the potential impact of negative feedback has on students. Teachers should provide positive feedback while also providing targeted feedback on areas for improvement.

There are factors that effect academic failure. Internal factors such as motivation, self-esteem, and time management have a significant influence on academic failure(Najimi et all, 2013). Students with low levels of motivation, low self-esteem, and low time management skills are most likely to experience academic failure (Najimi et all, 2013). Peer pressure can have a positive and negative impact to academic performance. A positive impact is it can encourage students to perform better for some students while peer pressure can also negatively impact academic performance (Mushtag & Khan,

2012). Peer pressure can put stress and anxiety on students. Students who have higher levels of anxiety and stress tend to perform worse academically (Mushtag & Khan, 2012). Furthermore, self-talk can influence student success. Negative self-talk can reduce student confidence (Malonley et all., 2013). Students with math anxiety that engage in negative self-talk can further worsen their anxiety and reduce their confidence in their math abilities (Malonley et all., 2013). The lack of confidence can increase anxiety and lead to more mistakes and have students be less engaged in the mathematical task. Students who reported higher levels of anxiety related to mathematics tend to have lower achievement (Fadilah et all, 2021). These factors can all contribute to the negative impact of math anxiety and math performance as the individual is less likely to perform to their full potential.

External factors also have a significant influence on academic failure. Examples of these external factors are quality of teaching, the viability of resources, and the level of support from friends and family(Najimi et all, 2013). Students who perceive the quality of teaching to be low are less likely to perform well academically (Najimi et all, 2013). Students who reported more positive perceptions of their mathematics teachers' teaching methods and abilities tend to have higher achievement in mathematics education (Fadilah et all., 2021). Other external factors such an organizational factors also effects students academic performance. These factors are university policies and procedures, social support availability for students, and economic situation. Students who perceive the university's policies to be fair with social support tend to be sufficient and perform well academically (Najimi et.all, 2013). The reserve of this effects students negatively in their academic performance. This negative performance has negative consequences for

students. Feelings of disappointment, decreased self-esteem, and decreased motivation is a result of bad academic performance (Najiami et.all, 2013). Students who experience failure are more likely to seek help from their peers rather than their instructors if the quality of teaching is not good (Najiami et all., 2013). This indicates a potential need for increased support and guidance from instructors.

Student's background can cause students to perform less well academically. The socio-economic status of a students family has a significant impact to their academic performance. Students from an economically disadvantage backgrounds tend to not perform well (Mushtag & Khan, 2012). Historically marginalized groups, such as students of color, students from low-income backgrounds, and students with disabilities are often underrepresented in advanced math courses which can impact their future academic and career opportunities (Copur-Gencturk, 2022). Students who had greater access to learning resources such as textbooks and internet access tended to have higher achievement in mathematics education (Fadilah et all., 2021). This can cause students to feel excluded or disengaged if they do not see themselves represented in the curriculum or if they do not see the relevance of the material to their lives of experiences (Copur-Gencturk, 2022). Furthermore, parental education can impact student success. The level of education that a student's parents attained can affect academic performance. Students whose parents have higher level of education tend to perform better academically (Mushtag & Khan, 2012). Students who came from families with high levels of education tend to have a high achievement in mathematics education as well (Fadilah et all., 2021). Parental income and parental support can also impact student success. Students who receive more support from their families such as financial support tend to perform better

academically (Mushtag & Khan, 2012). Student who reported having high levels of social support from families and friends tend to have higher achievement in mathematics education (Fadilah et all., 2021).

Student with a disability can also affect their success in mathematics. Students with ADHD (Attention deficit hyperactivity disorder) tend to have poor mathematical abilities compared to students without ADHD (Tosto et all, 2015). The poor mathematical abilities is poor mathematical skills, low math achievement, and poor math problem-solving abilities (Tosto et all, 2015). Also, students with more symptoms of ADHD were negatively associated with reading and mathematics performance (Hart et all, 2010). This shows that high levels of ADHD symptoms are associated with lower mathematics performance. Students with ADHA tend to perform poorly in arithmetic, particularly with performing calculations that require the working memory such as mental arithmetic (Tosto et all, 2015). Students with ADHD and anxiety combined together tended to have a more complicated relationship with math difficulties (Tosto et all, 2015). Environmental factors accounted for a large portion of the relationship between ADHD symptoms and mathematics performance (Hart et all, 2010). ADHD symptoms may impact underlying cognitive processes, such as working memory, attention, and processing speed, which in turn impact academic performance (Hart et all, 2010). Overall, it is important to take in account for a disability associated with mathematical performance.

Stress can impact students success. Stressful situations can impair math performance for students who are already anxious about math (Beilock, 2008). When students are under stress, their working memory capacity can be reduced (Beilock,2008)

This can make it more difficult to process and solve problems in mathematics (Beilock, 2008). Stress may reduce working memory capacity by disrupting the prefrontal cortex, which is responsible for executive functions (Beliock, 2008). The impact of stressful situations has a negative impact in mathematics performance. Stress can also impair attention. The increase of distractibility can increase the salience of irrelevant information and reducing the attentional control when under stress (Beilock, 2008). This can contribute to poor math performance and make it difficult for students to focus on mathematical tasks. Stereotypes can also cause stress for students. Stereotype threat, which is the fear that individuals may have of confirming negative stereotypes about their ability in mathematics (Beliock, 2008). This can occur when individuals feel they are being judged or evaluated based on the negative stereotypes. Stereotype threat can negatively impact math performance and increase anxiety and impair performance (Beliock, 2008). An example of this is if women are stereotypes as being less skilled at math than men, women may experience this stereotype threat when taking a math test. Both math anxiety and stereotype threat can impair working memory and cognitive resources which are important for math performance (Malonley et all., 2013). It is important to promote inclusion and diversity in education. This can reduce the negative impact of the stereotypes and improve the performance and engagement in mathematics.

Online learning has been a new impact to student success. The COVID-19 pandemic forced students to resort to online learning. Students impacted by the COVID-19 pandemic online learning were faced with a variety of challenges. Students faced difficulties with access to technology (Bringula et all, 2021). The technology impact also caused a difficulty to internet connectivity (Bringula et all, 2021). Some students did not

have the same resources to technology and internet as other students. Students who were more familiar with technology and had a higher computer self-efficacy tended to have more positive perception of online learning (Krishnan, 2016). This is a limitation to students who struggled to have technology and internet access to online learning. Students also reported having a lack of motivation and engagement in the online learning environment (Bringula et all, 2021). Students also reported feeling more isolated and less connected to their teachers and peers (Bringula et all, 2021). This contributes to feelings of frustration and dissatisfaction among students (Ariawan, 2022). These negative student feelings can have a negative impact on their learning. Mathematics self-concept was negatively affected by the transition to online learning (Bringula et all, 2021). Students reported lower grades and test scores in online math classes compared to face to face classes (Ariawan, 2022). Online learning provided students with a lack of personalized feedback. Students reported a more positive experience with face to face instructions since it was easier to ask questions and receive immediate feedback from their teachers (Krishnan, 2016). Educators can help improve students math self-concept and motivation by providing positive feedback, creating a supportive learning environment, and offering personal support and guidance (Bringula et all, 2021).

The purpose of this chapter was to examine the background of test anxiety. The research shows the important aspects that a student goes though in their education journey. As seen in the prior research conducted, there are aspects in a students education journey and academic performance. This research conducted connects a students journey to test anxiety in the testing environment, student confidence, disorders, external factors and online learning. Each of these aspects of a students education journey has a negative

impact on student performance. However, there is still a gap in the research that this study will fill. There is a gap in the research of test anxiety in the fields of mathematics in masters students. The next chapter will be on the methodology. of this study.

Chapter 3: Methodology

Introduction

This study aims to determine whether there is a relationship with test anxiety and student success. This study examines if test anxiety has a negative effect of passing the course in a masters level mathematics course. This study will examine if there is a relationship in homework grades, exam grades, gender, and test anxiety with the composite score of test anxiety from the Westside Test Anxiety Scale. Furthermore, this study will examine if there is a relationship with homework grades, exam grades, gender, and test anxiety with incapacity and worry score from the Westside Test Anxiety Scale. This chapter presents the overall methodology of the study. In this discussion are the setting and participants, instruments used, procedures used, and the data process and analysis that will be used for results in Chapter 4.

Subsection 1: Setting and Participants

This research will be conducted completely virtually at Shawnee State University. Shawnee State University is located in Portsmouth Ohio. Shawnee State University offers more than 100 associate, bachelor, master, and doctorate programs (Shawnee State University, 2019). Furthermore, 5 of these programs are graduate programs. Shawnee State University has approximately 3,216 students (Graduate Programs, 2013). Of those 3,216 students, 191 students are enrolled in graduate school (Graduate Programs, 2013). Furthermore, 124 students out of 191 graduate students have enrolled online exclusively

(Graduate Programs, 2023). The full-time students in the undergraduate programs consist of 54% women and 46% men (Graduate Programs, 2023). While on the graduate side, 77% are women and 23% are men (Graduate Programs, 2023). The Student Racial-Ethnic Diversity Breakdown is 83.9% white, 8.7% unknown, 3.4% African American, 2% Multi-Ethnic, .9% International, .6% Asian, and .4% Hispanic (Graduate Programs, 2023). The percentages of Racial Ethnic Demographics of Shawnee State University full-time Graduate Students are 95.5% white, 3.4% unknown, and 1.1% African American (Graduate Programs, 2023).

The participants of this study are only masters students enrolled in the online Masters of Science in Mathematics program. The specific mathematics courses evaluated are Abstract Algebra 1, Abstract Algebra 2, Advanced Linear Algebra, Regression 1, and Number Theory. The time this study collected its data was during the spring semester online at Shawnee State University. This means that the research was conducted from January 9th 2023 until May 2nd 2023. 68 students from the Masters of Science in Mathematics program will be planned to be evaluated.

To evaluate adequate power, G*Power was used. Using G*power, an F-test linear multiple regression using a fixed model being R^2 deviation from zero was used. The effect size would be a medium effect size which would mean the number to use would be 0.15. Also, alpha at 0.05 should be used to be standard. Thus, the desired power is 0.8 for the 80% power. The results from G*Power showed that a sample size of 55 is needed to have 80% power. This assuming all participants only took the survey once, all 68 participants that took the survey thus far will be evaluated in the study, so power is not

a concern. However, if student(s) took the survey more than once, the student(s) will be removed from the study and thus there is a slight concern for power.

Subsection 2: Instrumentation

In this study, exam scores will be collected. These exams are either midterm exams and/or final exams. Midterm exams are exams taken halfway between the course to cover the first half of the course, while final exams are a cumulative exam given at the end of a course (Wiggins, 2011). The purpose of these exams is to measure student performance and learning, identify areas where additional support is needed for the student, and evaluate the effectiveness of teaching methods (Kohn, 2000). Homework grades will also be collected. Homework grades will be averaged to determine a final homework grade for each student participating in the study. Final grade in the course will also be collected. At Shawnee State University in the Masters of Science in Mathematics, a grade B and above is passing the course.

A survey will also be used to collect data on test anxiety. The survey to be used will be the Westside Test Anxiety Scale. The Westside Test Anxiety Scale is an instrument designed to identify students with anxiety impairments who could benefit from an anxiety reduction intervention (Driscoll, 2007). The scale items cover self-assessed anxiety impairment and cognition which can impart performance (Driscoll, 2007). The Westside Test Anxiety Scale has 10 questions that are ranked from 5 to 1; 5 being extremely or always true, 4 being highly or usually true, 3 being moderately or sometimes true, 2 being slightly or seldom true, to 1 being not at all or never true. These 10 questions will be evaluated for the overall composite score. Individual questions will

also be evaluated. Questions 1,4,5,6,8, and 10 will be evaluated for incapacity while questions 2,3,7, and 9 will be evaluated as worry (Talwar, et all, 2019). For the purpose of this study, one question was added to the end of the survey to ask students for their gender, but this did not affect the process to analyze the survey responses of the Westside Test Anxiety Scale.

Subsection 3: Procedure

Institutional Review Board (IRB) approval from Shawnee State University was received on November 14th, 2022 and this approval was needed in order for the data collection process to begin for this study. A copy of this IRB approval is available in Appendix. This study only includes masters students at Shawnee State University in the Masters of Science in Mathematics program. The survey of the Westside Test Anxiety Scale was used along with the one question added asking the students' gender at the end of the survey. This survey was created in Google Forms by the researcher. This survey link from google forms was given to the professors that teach Abstract Algebra 1, Abstract Algebra 2, Number Theory, Advanced Linear Algebra, and Regression 1. The professors then distributed the link to the students by their professors. The responses were received by the researcher and given to the graduate director to clean the data of any personal identifying information. The graduate director removed students' names and gave each student a unique number for analysis. This data will then be sent to the researcher for data analysis.

To obtain students homework and exam scores, data was sent from professors teaching Abstract Algebra 1, Abstract Algebra 2, Number Theory, Advanced Linear

Algebra, and Regression 1 to the graduate director. The graduate director will then clean the data of any personal identifying information such as removing students' name. Each student will be assigned a number as a unique identifier. The graduate advisor will then combine the data results from the survey and data from professors; combining information and assigning the correct information to the students' specific unique number identifier. This unique number identifier insures the confidentiality of each student participating in this study. The data that will be received will be in excel document with the student unique identifier number, homework grade, exam grades, gender, test anxiety score, and course final grade to the researcher to analyze the results.

Subsection 4: Data Processing and Analysis

After consultation with research advisor, the primary research questions were restructured into the following:

1. Are homework grades, gender, and test anxiety as measured by the composite score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?
2. Are homework grades, gender, and test anxiety as measured by incapacity and worry score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?
3. Are exam grades, gender, and test anxiety as measured by the composite score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?

4. Are homework grades, gender, and test anxiety as measured by incapacity and worry score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?

After receiving the cleansed data from the graduate advisor in the excel file, the researcher will clean up the excel file. For example, if there is any missing data in columns, those participants will be removed from the study. Also, if there are any unique identifier duplicates, they will be removed from the study completely. These duplicates will happen if students took two or more classes at the same time the survey was distributed. Since, the same participant cannot be valued more than once, it is best to remove the student completely from the study rather than creating bias by choosing just one student response. Another clean up to the data file that the researcher will do is to average out the homework scores into one final homework grade. Finally, if midterm and exam grade is given for one student, the researcher will average out those two grades to only receive one exam grades. The reason behind this is since some classes were only given just a final exam while some other classes were given a midterm and a final exam.

To Measure test anxiety, the Westside Test Anxiety Scale will be used. The measurement for test anxiety will be broken down into 3 measurements. One measurement will be for the overall composite score, another will be for incapacity, and the last will be worry. Using the Westside Test Anxiety Scale, results from the 10 question will be summed up and divided by 10. This will result in the overall composite score on the Westside Test Anxiety Scale to be used to measure test anxiety. Furthermore, results for the incapacity measurement will be from questions 1,4,5,6,8,10 while results from the worry measurement will be from 2,3,7, and 9 (Talwar et all.,

2019). To measure incapacity and worry, the corresponding questions will be averaged to receive one final number to record for an incapacity or worry score.

Regression techniques and logistic regression techniques will be used to analyze the four primary research questions. T-tests will be used to analyze and produce results of the primary research questions. Similar techniques were used in similar studies. For example, in a study done on the Westside Test Anxiety Scale found that this scale is a reliable and valid measure of test anxiety among university students (Talwar et all., 2019). This suggests that the scale was measuring the construct of test anxiety as it was intended to do. Furthermore, Talwar used factor analysis and found that incapacity and worry emerged (Talwar et all., 2019). In the study done by Owan, multiple linear regression was used to investigate the effects of gender, test anxiety, and test items scrambling on students' performance in mathematics. This study found that using multiple linear regression on test anxiety had a negative effect on students' performance in mathematics (Owen, 2021). Students that had high levels of test anxiety performed worse on math tests than those with low test anxiety (Owen, 2021). Also, a study done by Hanfesa used multiple linear regression as well. Multiple linear regression was used to analyze the association between test anxiety and confounding factors such as age, gender, and academic performance (Hanfesa et all., 2020). Linear regression was also used to investigate the relationship between multiple predictor variable, such as sociodemographic and academic-related factors, and a single outcome variable which is test anxiety (Hanfesa et all., 2020). The results of this study showed that females were more likely to have test anxiety along with showing the providing proof that predictor

variables and single outcome variable have a negative relationship with test anxiety (Hanfesa et all., 2020).

Using linear regression and multiple linear regression will be important to analyze linearity, normality, homoscedasticity, and independence. Linearity will help determine if the relationship between the independent and dependent variables should be linear. Normality will help determine if the data is normally distributed. Homoscedasticity will help determine if the variance of the dependent variable should be equal across all levels of the independent variables. Finally, independence will help determine if the observation are independent of each other and not influenced by any other observation. This will help ensure that results from this study is reliable and valid to grow meaningful conclusions from the analysis of the results.

Summary

In conclusion, this chapter revealed the methodology of this studies research. This chapter explained the setting of Shawnee State University and the participants of the online students in the Masters of Science in Mathematics program. This chapter also went over the instrumentation of the data with having the professor and graduate director providing data to the research while also conducting a survey on test anxiety using the Westside Test Anxiety Scale. This chapter also went over the procedure of the data collection and the survey being used. Finally, data analysis was covered by using linear regression and multiple linear regression to analyze data from this study. Chapter four will report the results of the data analysis.

Chapter 4: Results

Introduction

This chapter presents the results of the data analysis of the research study. The purpose of this study was to determine test anxiety in masters students in mathematics at Shawnee State University. The research questions being analyzed are below:

1. Are homework grades, gender, and test anxiety as measured by the composite score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?
2. Are homework grades, gender, and test anxiety as measured by incapacity and worry score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?
3. Are exam grades, gender, and test anxiety as measured by the composite score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?
4. Are exam grades, gender, and test anxiety as measured by incapacity and worry score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?

Study Participants

The participants of this study were master students enrolled in the online Masters of Science in Mathematics program. The specific mathematics courses that were evaluated was Abstract Algebra 1, Abstract Algebra 2, Advanced Linear Algebra,

Regression 1, and Number Theory. The data collected for this study was collected during the online spring semester at Shawnee State University. The time frame that this data was collected was from January 9th 2023 till May 2nd 2023. 68 participants were initially planned to be evaluated. However, due to data cleaning, 38 participants were evaluated.

Data Cleaning

Data cleaning occurred after the spring semester concluded and final grades were submitted by the participating professors. The first round of data cleaning occurred with the results of the survey by the researcher. If a participant of the survey left a question blank, their response was removed from the survey. Even if the participant completed the questions from the Westside Test Anxiety Scale, but did not answer the gender question, their response was removed. The second round of data cleaning came after the results of the survey was submitted to the research advisor. The research advisor then gave each participant a number ID along with the participants' course grade, homework average, and exam score. This data was then received to the researcher for more data cleaning. If a participant with the same ID number answered the survey more than once, only their first response to the survey was taken as the data analysis and the other response(s) were removed. Their first response was known in the survey information based on the timestamp the survey was completed.

Description of Subjects

38 participants were included in this study. The participants were students in Regression 1, Advanced Linear Algebra, Number Theory, Abstract Algebra 1, and

Abstract Algebra 2. A summary of the frequencies of the participating students in these classes is provided in Table 1.

Table 1. Course Frequencies

Course	Number of students	Percent
Regression 1	14	36.8%
Advanced Linear Algebra	8	21.1%
Number Theory	6	15.8%
Abstract Algebra 1	8	21.1%
Abstract Algebra 2	2	5.2%

Of these 38 participants, gender was evaluated by male (n=27) and female (n=11). A summary of the mean and standard deviation of course information and test anxiety are summarized below in Table 2.

Table 2. Descriptive information of course

	Mean	Standard Deviation
Course Grade (Quality Points)	3.55	0.58
Homework Average	88.98	8.40
Exam Score	77.38	17.58
Overall Test Anxiety Score	2.96	0.98
Factor 1: Incapcity	17.11	6.10
Factor 2: Worry	12.53	4.39

Data Analysis

Research Question #1:

A direct logistic regression analysis was performed on academic success and three predictors: homework average, gender, and test anxiety measured by the composite score of the Westside Test Anxiety Scale. Data from n=38 students were available for analysis 24 (63.2%) students classified as successful getting and A-A- on course grade and 14 (36.8%) students classified as not successful getting B+ or lower. Analysis was performed using R (R Core Team, 2015).

A test of the full model with the three predictors against a constant-only model was statistically reliable, χ^2 (3, N = 38) = 19.21, p < .05, indicating that the set of predictors reliably distinguished between successful and not successful. The variance in course success accounted for is acceptable with McFadden's rho= 0.384, df=3. AIC for the full model (38.81) was lower than the constant-only model (52.02), indicating a slight better fit.

Prediction success (using the 0.5 as the threshold) was unimpressive with 29 out of 38 cases (76.3%) accurately classified or predicted correctly. Sensitivity and specificity values were 0.833 and 0.643, respectively.

Table 3 displays the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals for odds ratios for the three predictors. According to the Wald criterion, only Homework Average reliably predicted course success, z =2.697, p <.05. A model with Homework Average omitted was not reliably different from a constant only

model, χ^2 (3, N = 38) = 7.5962, p < .05; however, this model was reliable different from the full model, χ^2 (3, N = 38) = 11.61, p < .05. This confirms that Homework Average is the only significant predictor of course success among the predictor variable. The odds ratio of 1.245 shows change in the likelihood of course success based on a one-unit change in Homework Average.

Variance Inflation Factors (VIF) values ranged from 1.025 (Homework Average) to 1.281 (Test Anxiety Score) indicating that multicollinearity is not a problem. Examination of the significant levels of the interaction between each predictor and the log of itself (Hosmer & Lemeshow, 1989) indicated that linearity between each predictor and the legit of itself may be assumed.

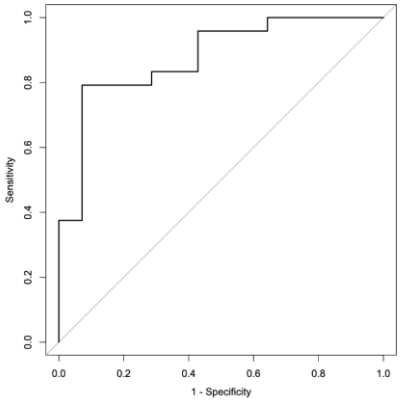
Table 3. Logistic regression analysis of course success as a function of student information

Variables	B	Wald (z-ratio)	p-value	Odds Ratio (OR)	95% CI Lower, OR	95% CI Upper, OR
Homework Average	0.219	2.697	0.007**	1.245	1.086	1.507
Gender	0.876	0.829	0.407	2.402	0.297	21.198
Test Anxiety Score (Overall)	-0.334	-0.589	0.556	0.716	0.221	2.191
(Constant)	-18.389	-2.373	0.018*	1.132e^-1	1.56e^-16	0.007

Using the three-predictor model, which was found to be statistically reliable, a receiver operating characteristic curve (ROC) is presented in Graph 1. Receiver operating characteristics graphs (ROC) have shown to be a reliable technique for visualizing, organizing, and selecting classifications. Sweets(1988) found that ROC analysis could be

extended for use in visualizing and analyzing behavior of diagnostic systems and for determining accuracy of a test using the area under the curve (AUC). The AUC was found to be .878 which indicated a good accuracy classification (Tape, 2015).

Graph 1. ROC Curve, Course Success



Research Question #2:

A direct logistic regression analysis was performed on academic success and four predictors: homework average, gender, and test anxiety measured by Factor 1 (Incapacity) and Factor 2 (Worry) of the Westside Test Anxiety Scale. Data from n=38 students were available for analysis 24 (63.2%) students classified as successful getting and A to A- on course grade and 14 (36.8%) students classified as not successful getting B+ or lower. Analysis was performed using R (R Core Team, 2015).

A test of the full model with the four predictors against a constant-only model was statistically reliable, χ^2 (4, N = 38) = 19.22, $p < .05$, indicating that the set of predictors reliably distinguished between successful and not successful. The variance in course

success accounted for is acceptable with McFadden's rho= 0.384, df=4. AIC for the full model (40.80) was lower than the constant-only model (52.02), indicating a slight better fit.

Prediction success (using the 0.5 as the threshold) was unimpressive with 29 out of 38 cases (76.3%) accurately classified or predicted correctly. Sensitivity and specificity values were 0.833 and 0.643, respectively.

Table 4 displays the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals for odds ratios for the three predictors. According to the Wald criterion, only Homework Average reliably predicted course success, $z = 2.581$, $p < .05$. A model with Homework Average omitted was not reliably different from a constant only model, χ^2 (3, N = 38) = 19.218, $p < .05$; however, this model was reliable different from the full model, χ^2 (3, N = 38) = 8.0852, $p < .05$. This confirms that Homework Average is the only significant predictor of course success among the predictor variable. The odds ratio of 1.249 shows change in the likelihood of course success based on a one-unit change in Homework Average.

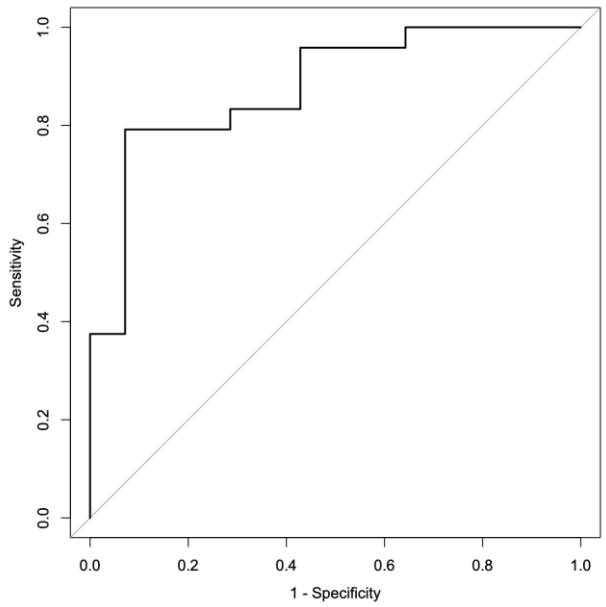
Variance Inflation Factors (VIF) values ranged from 1.138 (Homework Average) to 2.200 (Factor 1 Incapacity) indicating that multicollinearity is not a problem. Examination of the significant levels of the interaction between each predictor and the log of itself (Hosmer & Lemeshow, 1989) indicated that linearity between each predictor and the legit of itself may be assumed.

Table 4. Logistic regression analysis of course success as a function of student information

Variables	B	Wald (z-ratio)	p-value	Odds Ratio (OR)	95% CI Lower, OR	95% CI Upper, OR
Homework.Average	0.221	2.581	0.010**	1.249	1.082	1.534
Gender	0.878	0.832	0.405	2.406	0.297	21.201
Factor 1	-0.022	-0.185	0.853	0.978	0.760	1.236
Factor 2	-0.048	-0.316	0.752	0.9537	0.704	1.314
Constant	-18.635	-2.286	0.0223*	8.070e^-9	3.417e^-17	0.008

Using the four-predictor model, which was found to be statistically reliable, a receiver operating characteristic curve (ROC) is presented in Graph 2. Receiver operating characteristics graphs (ROC) have shown to be a reliable technique for visualizing, organizing, and selecting classifications. Sweets(1988) found that ROC analysis could be extended for use in visualizing and analyzing behavior of diagnostic systems and for determining accuracy of a test using the area under the curve (AUC). The AUC was found to be .878 which indicated a good accuracy classification (Tape, 2015).

Graph 2. ROC Curve, Course Success



Research Question #3:

A direct logistic regression analysis was performed on academic success and three predictors: exam grade, gender, and test anxiety measured by the composite score of the Westside Test Anxiety Scale. Data from n=38 students were available for analysis 24 (63.2%) students classified as successful getting and A to A- on course grade and 14 (36.8%) students classified as not successful getting B+ or lower. Analysis was performed using R (R Core Team, 2015).

A test of the full model with the three predictors against a constant-only model was statistically reliable, χ^2 (3, N = 38) = 41.265, p < .05, indicating that the set of predictors reliably distinguished between successful and not successful. The variance in course success accounted for is high with McFadden's rho= 0.825, df=3. AIC for the full

model (16.75) was lower than the constant-only model (52.02), indicating a slight better fit.

Prediction success (using the 0.5 as the threshold) was unimpressive with 29 out of 38 cases (76.3%) accurately classified or predicted correctly. Sensitivity and specificity values were 0.833 and 0.643, respectively.

Table 5 displays the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals for odds ratios for the three predictors. According to the Wald criterion, no predictors are statistically significant at the .05 level. However, only exam grade is statistically significant at the .1 level. At the .1 level exam grade reliably predicted course success, $z = 1.792$, $p < .1$. A model with exam grade omitted was not reliably different from a constant only model, χ^2 (3, N = 38) = 7.5962, $p < .05$; however, this model was reliable different from the full model, χ^2 (3, N = 38) = 33.67, $p < .05$. This confirms that exam grade is the only significant predictor of course success among the predictor variable at the .1 level. The odds ratio of 24417.13 shows change in the likelihood of course success based on a one-unit change in exam score.

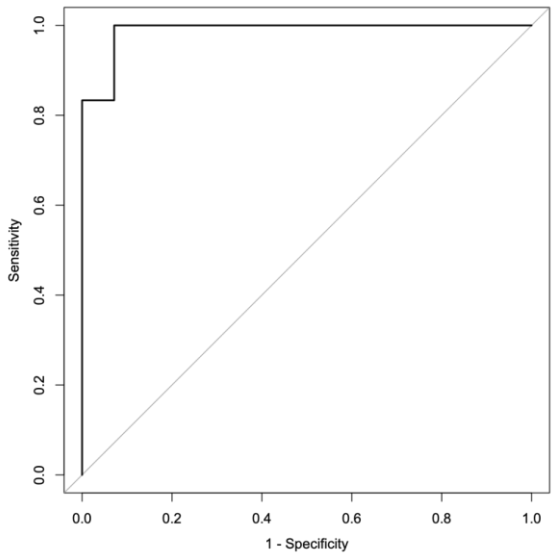
Variance Inflation Factors (VIF) values ranged from 3.837 (Test Anxiety Score) to 4.735 (Exam Score) indicating that multicollinearity is not a problem. Examination of the significant levels of the interaction between each predictor and the log of itself (Hosmer & Lemeshow, 1989) indicated that linearity between each predictor and the legit of itself may be assumed.

Table 5. Logistic regression analysis of course success as a function of student information

Variables	B	Wald (z-ratio)	p-value	Odds Ratio (OR)	95% CI Lower, OR	95% CI Upper, OR
Exam Score	10.103	1.792	0.073.	24417.130	7.312	$1.559e^{13}$
Gender	4.255	1.100	0.272	0.704	0.377	$1.974e^{7}$
Test Anxiety Score	1.311	0.605	0.545	3.709	0.196	2201.729
Constant	-41.835	-1.495	0.135	$6.780e^{-19}$	$1.874e^{-61}$	$5.079e^{-7}$

Using the three-predictor model, which was found to be statistically unreliable, a receiver operating characteristic curve (ROC) is presented in Graph 3. Receiver operating characteristics graphs (ROC) have shown to be a reliable technique for visualizing, organizing, and selecting classifications. Sweets(1988) found that ROC analysis could be extended for use in visualizing and analyzing behavior of diagnostic systems and for determining accuracy of a test using the area under the curve (AUC). The AUC was found to be .988 which indicated an exceptional accuracy classification (Tape, 2015).

Graph 3: ROC Curve, Course Success



Research Question #4

A direct logistic regression analysis was performed on academic success and four predictors: exam grade, gender, and test anxiety measured by Factor 1 (Incapacity) and Factor 2 (Worry) of the Westside Test Anxiety Scale. Data from n=38 students were available for analysis 24 (63.2%) students classified as successful getting and A to A- on course grade and 14 (36.8%) students classified as not successful getting B+ or lower. Analysis was performed using R (R Core Team, 2015).

A test of the full model with the four predictors against a constant-only model was statistically reliable, χ^2 (4, N = 38) = 43.58, $p < .05$, indicating that the set of predictors reliably distinguished between successful and not successful. The variance in course success accounted for is high with McFadden's rho= 0.871, df=4. AIC for the full model (16.44) was lower than the constant-only model (52.02), indicating a slight better fit.

Prediction success (using the 0.5 as the threshold) was unimpressive with 29 out of 38 cases (76.3%) accurately classified or predicted correctly. Sensitivity and specificity values were 0.833 and 0.643, respectively.

Table 6 displays the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals for odds ratios for the three predictors. According to the Wald criterion, no predictors reliably predicted course success.

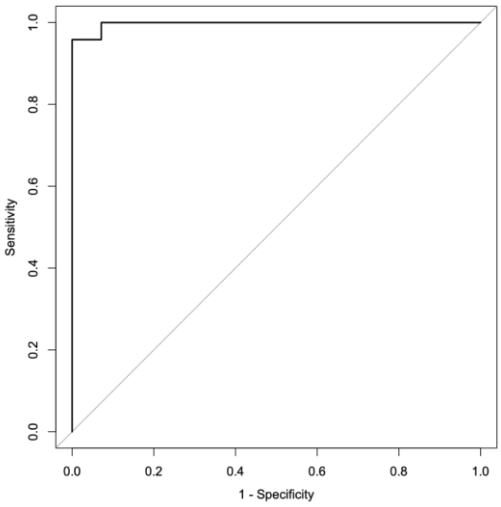
Variance Inflation Factors (VIF) values ranged from 10.857 (Factor 2 (worry)) to 93.193 (Exam Score) indicating that multicollinearity is a problem. Examination of the significant levels of the interaction between each predictor and the log of itself (Hosmer & Lemeshow, 1989) indicated that linearity between each predictor and the legit of itself may be assumed.

Table 6. Logistic Regression analysis of course success as a function of student information

Variable	B	Wald (z-ratio)	p-value	Odds Ratio (OR)	95% CI Lower, OR	95% CI Upper, OR
Exam Score	28.544	1.036	0.300	$2.491e^{12}$	5333.861	$2.449e^{61}$
Gender	9.342	1.069	0.285	11404.21	0.5394	$2.388e^{18}$
Factor 1 (Incapacity)	1.372	0.888	0.375	3.944	0.9374	2101.955
Factor 2 (Worry)	-0.551	-0.629	0.530	0.576	0.032	1.661
Constant	-123.366	-1.025	0.305	$2.649e^{-54}$	$1.887e^{-268}$	$5.516e^{-15}$

Using the four-predictor model, which was found to be statistically unreliable, a receiver operating characteristic curve (ROC) is presented in Graph 4. Receiver operating characteristics graphs (ROC) have shown to be a reliable technique for visualizing, organizing, and selecting classifications. Sweets(1988) found that ROC analysis could be extended for use in visualizing and analyzing behavior of diagnostic systems and for determining accuracy of a test using the area under the curve (AUC). The AUC was found to be .997 which indicated an exceptional accuracy classification (Tape, 2015).

Graph 4. ROC Curve, Course Success



Chapter Summary

The chapter presented the results of the research including the study participants, data cleaning, description of subjects, and data analysis. Data was collected using a

survey based of the Westside Test Anxiety Scale along with student data provided by the participating professors in Regression 1, Advanced Linear Algebra, Number Theory, Abstract Algebra 1, and Abstract Algebra 2. Hypothesis testing was performed for 4 hypotheses. Logistic regression techniques was used for data analysis. Two hypotheses were not rejected (1 & 2) and two hypothesis were rejected (3&4). More information on the summary of these results will be presented in Chapter 5

Chapter 5: Summary

Introduction

This chapter presents the summary of the results in chapter 4 followed by how the results correspond and imply the theatrical framework. Furthermore, this chapter will compare results to existing literature. Finally, this chapter will present the limitations of this study and provide recommendations for future studies.

The goal of this study was to close the gap of analysis in test anxiety and masters students in the field of mathematics. This study provides more range in the research of test anxiety in mathematics. Additionally, this study helps provide a better understanding of the impact of test anxiety and other factors to course success. The variables used in this study were test anxiety, course success, homework grade, exam grade, and gender.

This study was conducted online at Shawnee State University. The participants of this study were masters students enrolled in selected courses in the Masters of Science in Mathematics program. The courses evaluated was Abstract Algebra 1, Abstract Algebra 2, Regression 1, Number Theory, and Advanced Linear Algebra. The data was collected in two ways. First, the data was collected from participating professors. Second, the data on test anxiety was collected by the Westside Test Anxiety Scale along with a question added onto the survey asking the participant their gender. Furthermore, test anxiety was measured using three different scores. The composite score of test anxiety was used based of the results of the Westside Test Anxiety Scale. This was the overall average of the ten questions on the Westside Test Anxiety Scale. The other two score of test anxiety were broken up between Incapacity and Worry (Talwar et all., 2019). Incapacity was measured using the score from questions #1, 4, 5, 6, 8, and 10 while Worry was measure

using the score from questions #2 , 3, 7, and 9 from the Westside Test Anxiety Scale. The results of the study used regression techniques and logistic regression to analysis the data; the data analysis of these techniques were done using the statistical package of R (RCore Team, 2021).

Summary of Results and Implications

Research Question #1: Are homework grades, gender, and test anxiety measured by the composite score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?

Research Question #2: Are homework grades, gender, and test anxiety measured by incapacity and worry score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?

The results from the logistic regression model showed that homework grade was a significant predictor of course success ($p < .05$) for research question #1 and research question #2. This means that controlling for other predictors, the odds of course success increases 1.25 times each one unit increase in homework grade.

Implications of these results can be seen using Sigmund Freud's psychodynamic approach to psychology and how it creates anxiety. Sigmund Freud believes that anxiety is an unconscious conflict within the individual. This anxiety happened when the ego cannot control the conflict between the id and the superego. The ego is the reality of the person that uses rational thinking. The ego uses the logical thinking and problem solving strategies to navigate and achieve a goal. The id is the instincts, impulses, and urges without considering a consequence. The superego is the morality that incorporated the

values and morals of society that is learned. This superego sets the standards from right and wrong based on society. With homework grade being a statistically significant predictor of course success, the ego may experience conflict between the desire the achieve good grades (id) and the fear of falling short of expectations (superego). This internal and unconscious conflict can generate anxiety as students navigate through the course. A strong ego can help drive motivation and engagement with completing homework correctly and efficiently. This can lean towards higher quality of homework and contributing to course success.

Implications of these results can also be seen using Hans Eysenck. Eysenck theory of personality ties into the theory of test anxiety. Eysenck explains that there are different kinds of personality such as extroversion/introversion and neuroticism. Extraverts are people that receive their energy from interactions with other people. Introverts receive their energy from their own thoughts or from a small group of people. According to Eysenck, extraversion was caused by variability in brain activity. Introverts tend to have higher brain activity. Thus these high levels of brain activity make introverts more prone to anxiety. Eysenck also explains neuroticism which is a range he gave people from normal/calm to nervous/quiet. Neuroticism can also be split even more into two with high emotional stability to low emotional stability. Low emotional stability people can experience high levels of stress and anxiety. Thus a neurotic individual is sensitive to anxiety. Finally, Eysenck explained that anxiety can be inherited or learned from traumatic events causing unconditional fear. Thus anxiety is viewed as a conditioned fear that is part of an individual's personality. Implying this theory to the research results, students with high level of neuroticism can be more prone to

experiencing anxiety related to their homework grades. This anxiety can be driven by concerns about failure of perfectionism and self-doubt. Anxiety levels related to homework grade can impact motivation, focus, and have an overall affect of their course success. Since extraverts receive their energy externally, they may be more likely to seek assistance from teachers or collaborate with their peers. This approach can have a positive influence to their understanding of material, completing their homework successfully, and overall course success.

Research Question #3: Are exam grades, gender, and test anxiety as measured by the composite score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?

Research Question #4: Are exam grades, gender, and test anxiety measured by incapacity and worry score of the Westside Test Anxiety Scale significant predictors of course success at the masters level?

The results from the logistic regression model showed that there was no significant predictor of course success for research question #3 and research question #4. However, even though there is no significant predictor, the results can still be implied to Freud's and Eysenck's theories.

Implications of the results from research question #3 and #4 can still be implied using Freuds theory. According the Freud, anxiety is an unconscious response to the conflicts in the mind between the ego, id, and the superego. The ego may experience these unconscious conflicts between the desire to succeed (id) and the fear of falling short of expectations (superego). This internal and unconscious conflict can generate anxiety to a student that has pressure to perform well on exams and meet academic standards. This

can have an overall affect on course success. A strong ego can positively impact a students course success with a clear understanding of their academic goals and self-awareness. This self-awareness can guide the study choices of the students influencing exam grades and overall course success.

Implications of the results from research question #3 and #4 can still be implied using Eysenck's theory on personality. Neurotic individuals that have high levels of anxiety may experience more worry, self-doubt, and negative emotions which can contribute to test anxiety. These students with neuroticism are more likely to experience high anxiety before, during, or even after exams. This anxiety can negatively impact their performance, concentration, and memory recall which can affect overall course success. Also, since extraverts receive their energy externally, these students may be more likely to discuss and review the course material with peers in a study group and ask questions to their teachers. This approach has a more positive influence in understanding the course material, prep for the exam, and exam performance resulting in course success.

Literature comparison

Results from this study with having homework grade being a statistically significant predictor of course success connects to the existing research. Research has shown that a student that has a positive relationship with mathematics will tend to have higher test scores (Usher, 2009). This connects back to this study by creating a positive relationship with mathematics will allow a student to perform well on homework and exams resulting in course success. Research has also shown that students with high levels of motivation, high self-esteem, and high time management skill are more likely to

experience academic achievement (Najimi et all, 2013). This corresponds to this research with exam grades and Esycenck theory of personally. An extrovert will be more likely to be motived, have high self-esteem, and be better at time management resulting in overall course success. Research has also shown that positive feedback and encouragement from their teachers, peers, and parents reported having higher levels of self-efficiency in mathematics (Elastika et all, 2021; Cebito 2020; Utsta, 2017). Negative feedback can increase anxiety in mathematics (Fadilah et all, 2013). This also corresponds to Freuds theory on the unconscious conflict between the ego, id, and the superego. The less internal conflict can result in a greater homework grades resulting in overall course success.. Finally, students with math anxiety that engage in negative self-talk worsens their anxiety and reduce the overall confidence in their mathematic abilities (Mustag & Khan, 2012). This research can correspond to all research question showing how important it is self-talk is with completing homework and exam performance in their overall course success. When these students are under stress, their working memory can be reduced making it difficult to process and solve problems in mathematics. When a student is under stress completing their homework, their working memory can be reduced affecting a negative result in course success. This can also be seen before, during, and after and exam. Stress can have a negative result in course success.

Overall, the results from this study and the existing research prove the importance of homework. Students who consistently complete and perform well on homework assignment are more likely to succeed overall. The statically significant predictor of course success can imply an improvement in study habits. Students who regularly engage with their course material thought their homework are more likely to perform better on

their exams. Thus more practice in completing homework successfully can help develop a deeper understanding of the course material which can help a student perform better on exams and achieve course success.

Limitations

Considering the findings of this study, there was a very low sample size. Initially, this study had 68 participants. However, due to data cleaning presented in chapter 4, the sample size was lowered to 38 participants. This resulted in low power. Also due to data cleaning, the first response to the Westside Test Anxiety Scale was used if a student took the survey more than once. Another limitation was that the survey questions were assumed to be answered truthfully and accurately. If the students did not fully understand what the survey questions were asking, this could have altered with the data producing not accurate results. Additionally, a limitation that was present in this study was results from the different courses. Each course had different complexity levels, thus results may have varied since some courses are more difficult than others. Finally, another limitation to this study was altering course success. Course success was a dichotomized variable that was split between successful and not successful. Course success was broken down between successful being in the range of A to A- and not successful being B and below. The reason for this split was to make the dependent variable of course success more evenly distributed.

Recommendations

Seeing how low power was for this study due to the low same size, a recommendation would be to have a larger sample size to have more power. More power can determine a true effect between variables. A larger sample size can help with giving a study more reliable results. This can provide duties studies to have less random variation or sampling error in the data improving the generalizability in the data. Another recommendation for future studies is to use different universities with a more standard grading scale. Shawnee State University does use the grading scale that a B or higher is passing the course. However, the grading scale is different per class. For example, in one course a B was from range 63-76% while a B in another course was 50%-59.9%. Thus this inconsistent grading scale per course which can modify the data. Finally, a recommendation for future studies would be to incorporate imposter syndrome into the theatrical framework. Imposter syndrome is the persistent inability to believe that ones success is deserved or has been legitimately achieved as a result of ones own efforts or skills. (Huecker, et.all, 2023). These individuals have a difficult time internalizing their achievements and attribute their success to external factors such as luck. For example, a student with imposter syndrome will receive good grades and get praised for their academic achievement. However, they constantly doubt their abilities and believe they are only getting these good grades based off luck. These students will feel anxious or worried that they may be exposed as a fraud, feel insecure about their knowledge and skill, and be fearful of making any mistakes.

Summary

In conclusion, this chapter revealed the results of this study. This chapter explained the results and how they imply the theatrical framework along with connecting the results to existing research. This chapter also provided the limitation of this study along with providing recommendation for future studies.

This study evaluated 38 students at Shawnee State University enrolled in the online Maters of Science in Mathematics program. The courses being evaluated was Abstract Algebra 1, Abstract Algebra 2, Regression 1, Advanced Linear Algebra, and Number Theory. Logistic regression was used to determine course success from homework grade, gender, test anxiety, and exam grades. Results showed that homework grade is a statically significant predictor of course success.

This study should show students how important homework is to course success. Homework can be used as a reinforcement for learning to apply the concepts taught in class. It is also an important tool for practicing the subject matter to help better understand the material. Homework can be a great feedback tool that can give communication between the teacher and student about their learning in the course. Also, homework can be a great preparation tool for exams and indicator of course success. To teachers, it is also important to understand the statistically significant predictor of homework grade and course success. This can help teachers assess student understanding of the course material. Teachers can receive feedback on their end as well from homework to improve their teaching strategies to have a more productive learning environment. Also, teachers can look out for the introverts that are less likely to ask questions in front of a large group if they need help. Teachers can look out for these

introverts and address them individually to accommodate their needs on homework, exams, and contribute to course success.

References

American Psychological Association. (n.d.). *Apa Dictionary of Psychology*. American Psychological Association. Retrieved November 28, 2022, from https://dictionary.apa.org/test-anxiety

Arnald, E. (2022, June 23). Anxiety DSM-5 criteria and treatment overview- psych.com

Ariawan, I. P. (2022). The academic impact of online mathematics learning during COVID-19 for junior high school students. *Jurnal Elemen*, *8*(1), 131–143. https://doi.org/10.29408/jel.v8i1.4517

Berch, D.B., & Mazzocco, M.M. (2007). Why is math so hard for some children. *The nature and origins of mathematical learning difficulties and disabilities, 397-414*

Beilock, S. L. (2008). Math performance in stressful situations. *Current Directions in Psychological Science*, *17*(5), 339–343. https://doi.org/10.1111/j.1467-8721.2008.00602.x

Bowser, S. N. (2022). *Mathematics Confidence and Performance as Predictors of Mathematics Anxiety* [Electronic thesis or dissertation, University of Dayton]. OhioLINK Electronic Theses and Dissertations Center. http://rave.ohiolink.edu/etdc/view?acc_num=dayton1641815703183412

Bringula, R., Reguyal, J. J., Tan, D. D., & Ulfa, S. (2021). Mathematics self-concept and challenges of learners in an online learning environment during COVID-19 pandemic. *Smart Learning Environments*, *8*(1). https://doi.org/10.1186/s40561-021-00168-5

Bruno, A. J. (2015). *Do Mathematics and test anxiety Influence the Decision to Drop Out?* (dissertation). Oxford, OH.

Cassady, J. C. (2010). *Anxiety in schools: The causes, consequences, and solutions for academic anxieties*. Peter Lang Publishing Inc.

Cerbito, A. F. (2020). Comparative analysis of mathematics proficiency and attitudes toward mathematics of Senior High School Student. *International Journal of Scientific and Research Publications (IJSRP)*, *10*(05), 211–222. https://doi.org/10.29322/ijsrp.10.05.2020.p10125

Copur-Gencturk, Y. (2022). Achieving Equality and Excellence in Mathematics Teaching. *National Association Od State Boards of Education*, 37–42. https://doi.org/https://files.eric.ed.gov/fulltext/EJ1357139.pdf

Driscoll , R. (2007). Westside Test Anxiety Scale Validation. *American Test Anxiety Association*.

Elastika, R. W., Sukono, S., & Dewanto, S. P. (2021). Analysis of factors affecting students' mathematics learning difficulties using SEM as information for teaching improvement. *International Journal of Instruction*, *14*(4), 281–300. https://doi.org/10.29333/iji.2021.14417a

Eysenck, H.J. (1955). A dynamic theory of anxiety and hysteria. Journal of Mental Science, 101(422), 28-51.

Fadilah, Priyanda, R., & Amalia, R. (2021). Analysis of external factors affecting students' achievement student of Mathematics Education of Samudra University. *Journal of Physics: Conference Series*, *1806*(1), 012050. https://doi.org/10.1088/1742-6596/1806/1/012050

Fazio, L. K., Agarwal, P. K., Marsh, E. J., & Roediger, H. L. (2010). Memorial consequences of multiple-choice testing on immediate and delayed tests. *Memory & Cognition*, *38*(4), 407–418. https://doi.org/10.3758/mc.38.4.407

Freud, S., & Strachey, A. (2013). In *Inhibitions, symptoms and anxiety* (pp. 87–106). Martino Publishing.

Furner, J, M. & Duffy, M. (2002). Equity for all students in the new millennium: Disabling mathematics anxiety. Intervention in School and Clinic.

Graduate Programs: Shawnee State University. College Tuition Compare. (2023). Retrieved April 28, 2023, from https://www.collegetuitioncompare.com/graduate/shawnee-state-university/

Göloğlu Demir, C., & Kaplan Keleş, Ö. (2021). The Impack of High-Stakes Testing on the Teaching and Learning Processes of Mathematics. *Jorunal of Pedagogical Research*, *5*(2), 119–137. https://doi.org/https://files.eric.ed.gov/fulltext/EJ1315126.pdf

Hanfesa, S., Tilahun, T., Dessie, N., Shumet, S., & Salelew, E. (2020). Test Anxiety and Associated Factors Among First-Year Health Science Students of University of Gondar, Northwest Ethiopia: A Cross-Sectional Study. *National Library of Medicine*.

Hart, S. A., Petrill, S. A., Willcutt, E., Thompson, L. A., Schatschneider, C., Deater-Deckard, K., & Cutting, L. E. (2010). Exploring how symptoms of attention-deficit/hyperactivity disorder are related to reading and mathematics performance. *Psychological Science*, *21*(11), 1708–1715. https://doi.org/10.1177/0956797610386617

Hosmer, D.W. & Lemeshow, S. (1989) *Applied logistic regression*. New York: Wiley.

Kohn, A. (2000). The case against standardized testing:raising the scores, ruining the schools. *American School Board Journal*.

Krishnan, S. (2016). Students' Perceptions of Learning Mode in Mathematics. *The Malaysian Online Journal of Educational Sciences*, *4*(2). https://doi.org/https://files.eric.ed.gov/fulltext/EJ1096003.pdf

Maloney, E. A., Schaeffer, M. W., & Beilock, S. L. (2013). Mathematics anxiety and stereotype threat: Shared mechanisms, negative consequences and promising interventions. *Research in Mathematics Education*, *15*(2), 115–128. https://doi.org/10.1080/14794802.2013.797744

McLaughlin E.& Muncie, J. (2013). Criminological Perspectives: Essential Reading. Sage.

Merchak, R. (2013). *Recognition of Facial Expressions of Emotion: The Effects of Anxiety, Depression, and Fear of Negative Evaluation* (dissertation).

Mushtag, I., & Khan, S. N. (2012). Factors Affecting Students' Academic Performance. *Global Journal of Management and Business Research*, *12*(9). https://doi.org/https://globaljournals.org/GJMBR_Volume12/3-Factors-Affecting-Students-Academic.pdf

Najimi, A., Sharifirad, G., Amini, M. M., & Meftagh, S. D. (2013). Academic failure and students′ viewpoint: The influence of individual, internal and external organizational factors. *Journal of Education and Health Promotion*, *2*(1), 22. https://doi.org/10.4103/2277-9531.112698

Nersessian, Edward. (2013). Psychoanalytic theory of Anxiety, A Proposal for Reconsideration.

Norman, T. M. (2021). Examining the Relationship Between Test Anxiety and Growth Mindset Among Elementary School Students in a Test-Driven Culture. *Miami University*.

Owan, V. J. (2020). Effects of gender, test anxiety and test items scrambling on students' performance in mathematics: A quasi-experimental study. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3660167

Paul von der Embse, N. (2008). *High Stakes Testing, Socio-economic Status and Test Anxiety; Opportunities for Impact* (dissertation).

Pizarro Obaid, F. (2020). Neurotic anxiety. *Encyclopedia of Personality and Individual Differences*, 3213–3216. https://doi.org/10.1007/978-3-319-24612-3_1401

R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.

Risley, S. (2022). *Longitudinal Relationship between Child Evaluative Concerns and Social Anxiety: Does Seeking Perfectionism Predict Increases in Social Anxiety?* (dissertation).

Rickenberg, R., & Reeves, B. (2000). The effects of animated characters on anxiety, task performance, and evaluations of User Interfaces. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. https://doi.org/10.1145/332040.332406

Shawnee State University enrollment increased by nearly 12% for Fall 2019 as it welcomes more than 1,000 new students. Shawnee. (n.d.). Retrieved April 28, 2023, from https://www.shawnee.edu/news/shawnee-state-university-enrollment-increased-nearly-12-fall-2019-it-welcomes-more-1000-new

Solow, D. (2014). In *How to read and do proofs: An introduction to mathematical thought processes* (pp. 1–41). story, Wiley.

Soyturk, I. (2021). *The Revised Test Anxiety-Online-Short Form Scale: Bifactor Modeling* [Doctoral dissertation, Kent State University]. OhioLINK Electronic Theses and Dissertations Center. http://race.ohiolink.edu/etdc/view?acc_num=kent1626280641872514

Sung, Y.-T., Chao, T.-Y., & Tseng, F.-L. (2016). Reexamining the relationship between test anxiety and learning achievement: An individual-differences perspective. *Contemporary Educational Psychology*, *46*, 241–252. https://doi.org/10.1016/j.cedpsych.2016.07.001

Tape, T.G. (2015) Interpreting diagnostic tests: The area under an ROC curve. Retrieved from http://gim.unmc.edu/dxtests/roc3.htm

Tosto, M. G., Momi, S. K., Asherson, P., & Malki, K. (2015). A systematic review of attention deficit hyperactivity disorder (ADHD) and mathematical ability: Current findings and future implications. *BMC Medicine*, *13*(1). https://doi.org/10.1186/s12916-015-0414-4

Usher, E. L. (2009). Sources of middle school students' self-efficacy in mathematics: A qualitative investigation. *American Educational Research Journal*, *46*(1), 275–314. https://doi.org/10.3102/0002831208324517

Usta, H. G. (2017). Examination of the Relationship between TEOG Score Transition (from Basic to Secondary Education), Self-Confidence, and Self-Efficacy and Motivation Level. *Journal of Education and Practice*, *8*(6), 36–43. https://doi.org/https://files.eric.ed.gov/fulltext/EJ1133074.pdf

Wiggins, G. (2011). A true test: Toward more authentic and Equitable Assessment. *Phi Delta Kappan*, *92*(7), 81–93. https://doi.org/10.1177/003172171109200721

Wright, N. (2002). Medical students' compliance with simple administrative tasks and success in final examinations: Retrospective Cohort Study. BMJ, 324(7353), 1554–1555.

Zaika, O., Vakaliuk, T., Riabko, A., Kukharchuk, R., Mintii, I., & Semerikov, S. (2021). Selection of online tools for creating math tests. CEUR Workshop Proceedings.

Appendix A

Shawnee State University

Study # 2022-17

Exempt Review Application

Title of Research Project:
Test Anxiety in Masters Students

Name of Principal Investigator	Email Address	Phone Number
Douglas Darbro	ddarbro@shawnee.edu	740-351-3441

Department(s)/Division/Agency Mathematics

Name(s) of Co-Investigators:	Email address:	Faculty	Student	Other
Jenna Nottle	nottlejenna@gmail.com	☐	☒	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐

*Please place an asterisk by the investigator name(s) whose NIH certificate(s) is/are already on file with the IRB, if the certificate is less than 3 years old.

Please place a check mark next to the category that best describes your research. You may check more than one category.

- ☒ Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (a) research on regular and special education instructional strategies, or (b) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
- ☐ Research involving the use of educational tests (e.g., cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (a) data obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (b) any disclosure of the human subjects' responses outside the research could reasonably place the participants at risk of criminal or civil liability or be damaging to the participants' financial standing, employability, or reputation. No videotaping or photography is allowed for data collection. You may not collect data from appointed public officials or candidate for public office.

- ☐ Research involving the collection or study of existing information, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.
- ☐ Research and demonstration projects that are conducted by or subject to the approval of supporting agencies, and which are designed to study, evaluate, or otherwise examine: (a) public benefit or service programs; (b) procedures for obtaining benefits or services under those programs; (c) possible changes in or alternatives to those programs or procedures; or (d) possible changes in methods or levels of payment for benefits or services under those programs.
- ☐ Taste and food quality evaluation and consumer acceptance studies, (a) if wholesome foods without additives are consumed or (b) if a food is consumed that contains a food ingredient at or below the level, and for a use, found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration and approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

Does your research include at least one of the above criteria? Yes X **No**

1. Describe the key demographics (age, SES, ethnicity, geographic locations, gender, etc) of the sample that you wish to obtain.

Participants will be 18 years or older at Shawnee State University. There is no exclusion criteria for gender or ethnicity

1a. What is the greatest number of participants that will be recruited? 150

1b. How will participants be recruited

Data will be collected from institutional data from Shawnee State University. Data will also be collected by the Westside test anxiety scale

2. Will participants be remunerated for their participation? Yes No X

2a. If so, how will participants be remunerated? Please indicate the type of remuneration and the amount. For instance, the participants will be given a $10 Amazon Gift Card for participation or the participants will receive 3% of their final grade in extra credit in their Introduction course.

n/a

2b. If participants do not complete the study, will partial or full remuneration be given? Please describe how that will be determined.
n/a

3. What direct benefits (other than remuneration) exist for the participants who participate?
n/a

4. What direct risks could the participants potentially face? Check all that apply.

_____ Risk of breach of confidentiality or privacy

_____ Risk of coercion by researcher(s)

_____ Risk of psychological harm

_____ Risk of physical harm

_____ Other potential risk: _____

If you checked any direct risks in Item 4, then you should complete the "Expedited and Full Review Application."

5. Will the participants be informed of the risks and benefits of the study? Yes No x

5a. If so, how will the participants be informed?
n/a

5b. Please check each box if the following criteria match your research.

- ☒ The research involves no greater than minimal risk.
- ☒ It is not practicable to conduct the research without a waiver of informed consent or alteration to informed consent.
- ☒ Waiving or altering the informed consent will not adversely affect the subjects' rights and welfare.
- ☒ The consent document would be the only record linking the subject and the research, and the principal risk would come from a breach of confidentiality.

5c. Do you wish to waive the signed informed consent? Yes x No

Shawnee State University

Study # 2022-17

In submitting this form and the corresponding documents, I acknowledge that I have completed Human Research Participants training and that I understand and will uphold the rights of human participants. I also verify that all information contained in this form and any other corresponding documentation is correct based on my knowledge. I understand that I may not have contact with any research participants until the Shawnee State University IRB has given me their approval. I also understand that I must file an ***Amendment/Modification Form*** if my project extends beyond a year from my approval date and I must file a ***Final Study Form*** with all consent forms once the study is complete.

DocuSigned by: Douglas Darbro 4DFACE6D0794406...
Signature of Principal Investigator 1

DocuSigned by: Jenna Mottle 5ADBCD3B6026429...
Signature of Co-Investigator 2

Signature of Co-Investigator 3

Signature of Co-Investigator 4

Signature of Co-Investigator 5

Signature of Co-Investigator 6

Date of Submission: 10/28/2022 | 12:49 AM EDT

Please compile attachments into one document for each category. If any forms below are not applicable, please attach reasons why.

Human Research Training Certificates:

Data Collection Questions and Forms:

Research Summary:

Consent Forms:

Assent Forms:

Advertisements:

Revisions Requested Yes No X IRB Chair Signature DocuSigned by: Tim Hamilton 1DFBACF9332348D...

DS JN

Date sent for revision (if applicable): _____

Please attach revisions requested with changes clearly marked

Changes marked

Final copy

Westside Test Anxiety Scale

Rate how how true each of the following is of you, from extremely or always true, to not at all or never true. Use the following 5 point scale. Circle your answer.

5	4	3	2	1
extremely always true	Highly usually true	moderately sometimes true	slightly seldom true	not all all never true

__1. The closer I am to a major exam, the harder it is for me to concentrate on the material

1 2 3 4 5

__2. When I study, I worry that I will not remember the material on the exam.

1 2 3 4 5

__3. During important exams, I think that I am doing awful or that I may fail.

1 2 3 4 5

__4. I lose focus on important exams, and I cannot remember material that I knew before the exam

1 2 3 4 5

__5. I finally remember the answer to exam questions after the exam is already over.

1 2 3 4 5

__6. I worry so much before a major exam that I am too worn out to do my best on the exam.

1 2 3 4 5

__7. I feel out of sorts or not really myself when I take important exams.

1 2 3 4 5

__8.I find that my mind sometimes wanders when i am taking important exams.

1 2 3 4 5

__9.After an exam, I worry about whether I did well enough.

1 2 3 4 5

__10. I struggle with writing assignments, or avoid them as long as I can. I feel that whatever I do will not be good enough.

1 2 3 4 5

BIBLIOGRAPHY

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Master of Science Mathematics

Thesis: THE EXAMINATION OF TEST ANXIETY, HOMEWORK GRADE, EXAM GRADE, AND GENDER TO DETERMINE COURSE SUCCESS IN MASTERS STUDENTS

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