Trait and State Anxiety in Doctor of Physical Therapy (DPT) Students

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Abstract

It is well established that graduate healthcare students, including Doctor of Physical Therapy (DPT) students, experience more anxiety when compared to normative populations. Because elevated anxiety levels may impede academic performance, and can have negative long-term health consequences, measuring for its presence and determining underlying factors are essential first steps to mitigating this problem.

Objectives: This study examined individual and environmental factors, as considered by the stress-diathesis model, to determine which individual attributes and environmental circumstances most contribute to anxiety in DPT students at Neumann University (NU). The impact of race, gender, length of enrollment, grade point average (GPA), socioeconomic status, having a personal or family history of anxiety, and the practice of utilizing management strategies, on anxiety, measured by the validated State Trait Anxiety Inventory (STAI), was investigated in this study. This study also gathered information about test-taking anxiety and which strategies are most frequently used to manage anxiety within the study population.

Methodology: This repeated-measures, quantitative, quasi-experimental study consisted of a sample of convenience comprised of eligible NU DPT students. Participants initially completed both the state (STAI-S) and trait (STAI-T) subscales of the STAI, and a data collection questionnaire, on a non-test day. Next, participants were randomized into two groups: written (W) and practical (P). Finally, they re-took the STAI-S on Blackboard within 30 minutes of either a written or practical examination, depending on their assigned group.

***Results*:** Findings for this study include a total of 44 participants. Nine did not complete all sections, including five who did not complete the repeated measures STAI-S. Participant scores on the initial STAI-S and STAI-T were slightly elevated when compared to norms at

baseline, with a significant increase in the STAI-S when re-measured within 30 minutes of an exam. There was not a statistically significant difference in the STAI score based on the type of exam, gender, race, year in school, income, parental education level, the number of participant life roles, or having an anxiety management strategy. Significant relationships were found between participants with either a parent/guardian who had anxiety, a personal history of anxiety and, or participants currently experiencing anxiety, and increased anxiety, with participants reporting these conditions having greater STAI scores. Weak inverse relationships were found between both age and the number of hours worked, and STAI-S scores, with older participants and those who worked more hours, having lower STAI scores. The most common anxiety management strategy reported was exercise, followed by talking with a friend or loved one. The most common physical symptom of anxiety reported before test-taking was an increase in heart rate followed by sweating.

Keywords: Doctorate Physical Therapy, anxiety, STAI, test-taking anxiety

Dedication Page

This project is dedicated to my children, Brady, and Eli. May you feel inspired by acquiring knowledge and find true joy and purpose in your lives. Thank you for your patience with me while I worked on this project. I look forward to spending more time with you and being fully present as you navigate your life journeys. I hope you know that I will always be there for both of you, no matter what.

Thank you to my family for your continued unconditional love and support. Thanks to my mom, Theresa, for showing up whenever I asked her to, and for jumping in to handle the overflow of household chores and childcare obligations. I could not have done this without you. Thanks to my dad, David, for always believing in me and knowing how to guide me in a gentle and unassuming manner. Thanks to my brother, Sean, for always having my back and continuing to inspire me with his continued self-growth and constant integrity.

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List of Abbreviations

BDI.....Beck Depression Inventory

BSI .....Brief Symptom Index

CAPTE.....Commission on the Accreditation in Physical Therapy Education

CDC .....Centers for Disease Control and Prevention

DASS .....Depression Anxiety Stress Scale

DSM-5.....Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

DPT .....Doctor of Physical Therapy

GPA.....Grade Point Average

GSI .....Global Severity Index

H.....Hypothesis

IRB.....Institutional Review Board

NPTE.....National Physical Therapy Exam

NU.....Neumann University

OSCE .....Objective Structured Clinical Examination

OT .....Occupational Therapy

P .....Practical exam group

PA .....Physician Assistant

PT.....Physical Therapy

RQ.....Research Question

SLP.....Speech Language Pathology

STAI.....State Trait Anxiety Inventory

STAI-S .....State Trait Anxiety Inventory, State subscale

STAI-T.....State Trait Anxiety Inventory, Trait subscale

SWB.....Subjective Well Being

TAI.....Test Anxiety Inventory

TAI-G.....German Test Anxiety Inventory

U.S. .....United States

W.....Written exam group

WTAS .....Westside Test Anxiety Scale

Chapter One

Introduction

According to the definition from *The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) anxiety is the "anticipation of a future threat" related to the fear response, which is described as the emotional response to either a real or perceived imminent threat (American Psychiatric Association, 2013). Understanding the influence of anxiety is complex. Anxiety may assist with self-preservation, and at times, enhance performance. Some studies report that slight increases in anxiety improve test performance because of increased attention and motivation (Mesurado et al., 2016; Sarid et al., 2004). However, when anxiety reaches high levels, persists beyond stressful circumstances, or is triggered in non-threatening situations, it is considered maladaptive and can have harmful consequences (Sylvers et al., 2011; Wong et al., 2017).

Anxiety disorders are the most prevalent mental health disorder worldwide (Stein et al., 2017). According to Gallagher (2014), college counseling centers reported an 89% increase in students presenting with anxiety disorders from 2009 until 2014. Winerman (2017) reported that 61% of college students who seek counseling within these centers are doing so to manage anxiety. Graduate allied health professional students, including Doctor of Physical Therapy (DPT) students, the population for this study, report more stress and anxiety than age-matched peers (Bogardus et al., 2021; Kafeel et al., 2018; Webber et al., 2020).

Results from the National College Health Assessment (2018) found that professional and graduate students perceive the symptoms associated with anxiety, depression, and stress are among the leading factors impacting academic performance. Educational theories exploring factors influencing academic performance have shown that prior achievement, motivation, age,

home environment, motivation, and peer group are all factors that influence academic outcomes (Iverson & Walberg, 1982; Uguroglu & Walberg, 1979; Walberg et al., 1986).

The stress-diathesis model was incorporated into this study as a framework to investigate both the inherited traits and external sources of anxiety in DPT students. This model was introduced in the 1960s by Paul Meehl (1962) to describe the development of psychopathology in persons with Schizophrenia. The stress-diathesis model seeks to identify underlying individual attributes and family history, as well as environmental stressors that contribute to impairment (Kendler et al., 2002). The stress-diathesis model has helped explain underlying causes of pathologies such as depression (Hammen, 2005), posttraumatic stress disorder (McKeever & Huff, 2003), schizophrenia (Walker, 1997), congestive heart failure (Ordovas et al., 2002), and infectious disease (Hill, 2001).

Statement of the Problem

The elevated levels of anxiety found in DPT students are consistent with elevated anxiety levels reported in health professions graduate students (Bullock et al., 2017; Macauley & Plummer, 2017) and medical students (Adhikari et al., 2017; Ediz et al., 2017; Fawzy & Hamed, 2017). Stress and anxiety are known to negatively impact health (Rice, 2010), decrease quality of life (Gorji et al., 2012), and may cause depression (Dyrbye et al., 2006; Rana, 2010), and burnout (Dyrbye et al., 2010), all of which can negatively impact DPT students. Determining the underlying contributing factors to anxiety in this population, as well as objectively measuring anxiety, and the impact of different environmental circumstances that cause it to increase, such as specific types of assessment, is an essential first step to enabling DPT educators to develop anxiety reduction strategies.

Significance of the Problem

Sustained anxiety can increase blood levels of cortisol (Fischer & Cleare, 2017) and predispose individuals to health issues including, but not limited to, heart disease (Palacios-Ceña al., 2017), metabolic syndrome (Chan et al., 2019), and tension headaches (Palacios-Ceña et al., 2017). In addition to adverse physical health effects (Thomas-Davis et al., 2020), anxiety in graduate healthcare students, including DPT students, has been linked to poor academic performance (Dawood et al., 2016; Steinmayr et al., 2018), decreased empathy (Barbosa et al., 2013), relationship challenges (Webber et al., 2020), decreased quality of life (Kebede et al., 2019), and mental health issues (Thomas-Davis et al., 2020; Webber et al., 2020).

Furthermore, a study by Hoying et al. (2020) examining the correlation between depression, anxiety, stress, and health in first-year graduate health science students reported 6% of participants had suicidal ideation. This is especially concerning because, as reported by the Centers for Disease Control and Prevention (CDC), in 2019 suicide was the second leading cause of death in persons between the ages of 10 and 34 (National Institute of Mental Health, 2022).

Purpose and Significance of the Research

The purpose of this study was to utilize the stress diathesis model, which links existing disorders to the predisposition of an individual, as well as their environmental influences, to determine which factors contribute to anxiety in DPT students, as well as, what, if any, strategies are successful in decreasing anxiety. To objectively measure anxiety levels, the State-Trait Inventory (STAI) was utilized to measure both trait (STAI-T) and state (STAI-S) anxiety at baseline. STAI-S was re-measured within 30 minutes before either a written or practical examination to determine the impact of test-taking conditions on anxiety. Relationships between objective measures of anxiety and the number life roles, history/family history of anxiety, year in

school, grade point average (GPA), and socioeconomic status were also assessed. Finally, the utilization anxiety management strategies and their impact on STAI scores were examined.

Identifying the factors that contribute to anxiety in DPT students will enable educators to develop strategies to reduce anxiety in this population. In addition, a comparison of STAI scores among DPT students currently using anxiety reduction strategies and those who are not will provide valuable insight into anxiety management for this population. Given the known elevated levels of anxiety in DPT students, research investigating the attributes that predispose an individual to anxiety, as well as the environmental influences in physical therapy school, is needed to develop targeted anxiety reduction strategies. These changes may ultimately improve academic performance and quality of life for DPT students. Furthermore, the findings may apply to students in other health professions.

Research Questions and Hypotheses

RQ1: Is there a statistically significant relationship between DPT students' scores on the STAI and their gender, racial identity, age, length of enrolled in the DPT program, income level, hours worked per week, and/or educational level of parents/guardians?

H1.1$_O$: There is not a statistically significant relationship between DPT students' gender identity and score on the STAI.

H1.1$_A$: There is a statistically significant relationship between DPT students' gender identity and score on the STAI, with persons identifying as female scoring significantly higher.

H1.2$_O$: There is not a statistically significant relationship between DPT students' racial identity and score on the STAI.

H1.2$_A$: There is a statistically significant relationship between DPT students' racial identity and score on the STAI, with persons from minority groups scoring significantly higher.

H1.3$_O$: There is not a statistically significant relationship between DPT students' age and score on the STAI.

H1.3$_A$: There is a statistically significant inverse relationship between DPT students' age and anxiety as reflected by lower STAI scores for older students

H1.4$_O$: There is not a statistically significant relationship between DPT students' year in the DPT program and score on the STAI.

H1.4$_A$: There is a statistically significant inverse relationship between DPT students' year in the DPT program and anxiety, as reflected by lower STAI scores for students in their third year compared to those in the first or second year.

H1.5$_O$: There is not a statistically significant relationship between DPT students' income level and scores on the STAI.

H1.5$_A$: There is a statistically significant inverse relationship between DPT students' income and scores on the STAI, with persons who report a lower income scoring significantly higher on the STAI.

H1.6$_O$: There is not a statistically significant relationship between the number of hours per week a DPT student works and their STAI scores.

H1.6$_A$: There is a statistically significant positive relationship between the number of hours per week a DPT student works and their STAI scores, with those working more having higher STAI scores.

H1.7$_O$: There is not a statistically significant relationship between the educational level of a DPT students' parents and their STAI score.

H1.7$_A$: There is a statistically significant inverse relationship between the educational level of a DPT students' parents/guardians and their STAI score, with who have parents with less education scoring higher on the STAI.

RQ2: Is there a statistically significant difference between the amount of anxiety, as measured by STAI-S scores, for DPT students taking a written or a practical examination within the next 30 minutes?

H2$_O$: There will be no significance difference in STAI-S scores 30 minutes prior to DPT students taking a practical exam when compared to a written exam.

H2$_A$: DPT students taking a practical exam will have a statistically significant higher STAI-S scores 30 minutes prior to taking the practical exam compared to the STAI-S scores of DPT students 30 minutes prior to taking a written exam.

RQ3: Do DPT students with more life roles experience greater anxiety, resulting in statistically significant higher STAI scores than those with less life roles?

H3$_O$: DPT students with more life roles will not have statistically significant higher STAI scores when compared to those with less life roles.

H3$_A$: DPT students with more life roles will have statistically significant higher STAI scores when compared to those with fewer life roles.

RQ4: Do DPT students who report currently being anxious score higher on the STAI?

H4$_O$: DPT students who currently report higher levels of anxiety on the data collection questionnaire will not score statistically significantly higher on the STAI.

$H4_A$: DPT students who currently report higher levels of anxiety on the data collection questionnaire will score statistically significantly higher, than those who do not, on the STAI.

RQ5: Do DPT students with a history of anxiety themselves or a parent/guardian with a history of anxiety have greater anxiety, as measured by the STAI?

$H5.1_O$: DPT students who report a history of anxiety will not score higher on the STAI than those who do not.

$H5.1_A$: DPT students who report a history of anxiety will score statistically significantly higher on the STAI than those who do not report a history of anxiety.

$H5.2_O$: DPT students with a parent/guardian with a history of anxiety will not score statistically significantly higher on the STAI than those who do not report a patient/guardian with a history of anxiety.

$H5.2_A$: DPT students with a parent/guardian with a history of anxiety will score statistically significantly higher on the STAI than those who do not report a patient/guardian with a history of anxiety.

RQ6: Do DPT students who report anxiety management strategies score lower on the STAI? If so, which strategies appear most effective?

$H6_O$: DPT students with anxiety reduction strategies will not have statistically significantly lower STAI scores than those who do not have strategies.

$H6_A$: DPT students with anxiety reduction strategies will have statistically significantly lower STAI scores than those who do not have strategies.

Organization of the Study

This manuscript is organized into five chapters. The first chapter introduces the topic of anxiety, including the types and proposed underlying mechanisms, as well as implications for those with anxiety. The second chapter introduces the study population, DPT students, as well as the existing literature examining anxiety in this population, including the proposed causes and impact. In addition, this chapter describes research supporting the stress-diathesis model, which is the framework used in this study to consider the sources of anxiety, and the STAI instrument, which this study utilizes to objectively measure both state and trait anxiety. The third chapter describes the methodology of this study, including the sample, development of the data collection questionnaire, data collection, and analysis. The fourth chapter describes the results of this study and answers each research question based on the findings. The fifth chapter discusses the findings in relation to the existing research, provides a conclusion of the findings from this study, and offers suggestions for changes based on the findings as well as future studies.

Chapter Two

Review of Literature

Many studies establish that anxiety levels for DPT students exceed those expected for comparative norms (Bogardus et al., 2021; Kafeel et al., 2018; Webber et al., 2020). However, the underlying causes and environmental influences that increase anxiety in this population is not fully understood. Findings from recent studies suggest the pressure to perform well academically, the responsibilities of being a graduate student (Bogardus et al., 2021; Webber et al., 2021), and a fear of failure (Bogardus et al., 2021) are common themes that cause anxiety in DPT students. Additional contributing factors include the female gender (Macauley & Plummer, 2017), taking examinations (Dawood et al., 2016; Zhang & Walton, 2018), a history and/or a family history of mental illness (Bogardus, 2019), older age of student (Williams et al., 2018), and prior academic performance (Macauley & Plummer, 2017).

This review will begin by describing the incidence and prevalence of anxiety in the study population. Next, the types of anxiety will be described, including test-taking anxiety, as well as the potential causes of anxiety in DPT students. Next, the stress-diathesis model and implications, when applied to anxiety in the target population, will be explored, as well as the psychometric properties of the STAI, the test used in this study to quantify both state and trait anxiety. Finally, this section concludes with a discussion about the gaps in the literature and how these findings guided the study methodology.

Search Strategy

The first literature search for this research project occurred between February 10 and March 1, 2020, as part of a Research Methods class (HSCI 715) at Radford University. During this initial search, the databases PubMed and Google Scholar were utilized. The search string

"Anxiety AND physical therapy students" yielded 357 results using PubMed and 1,660,000 using Google Scholar. Once the search was reduced on Google Scholar to articles published since 2018, the results decreased to 18,600 results within this database.

To find articles most relevant to this study, articles with study participants outside the target population of physical therapy students and/or allied health professionals were excluded. In addition, studies that described experiences outside of the classroom and/or clinical rotations of allied health students were also excluded. These limitations yielded 45 articles total from both databases, 24 of which were utilized in this review.

Additional terms searched using these databases, during the same time, included "test-taking anxiety AND physical therapy students," and "stress-diathesis model." The first two additional search terms yielded between 17,000 and 17,500 results on Google Scholar and five and 7,218 on PubMed. Articles more than 5 years old, and/or that did not specifically describe test-taking anxiety and/or the implications of the stress-diathesis model, were excluded, yielding 19 additional articles included in this review.

Next, before writing the IRB proposal for the pilot study of anxiety in DPT students, a second literature search, using the same search strings and search engines described prior, was conducted during the spring of 2021 between March 15 and April 10. These searches were both limited to articles published since 2020. This updated search yielded four additional articles that had not been identified prior.

In addition, at this time, a new search for articles about the State Trait inventory, the objective measure of anxiety used for this study, was conducted using the databases PubMed and Google Scholar. The strings "State Trait anxiety inventory" and "STAI" were searched with the range limited to since 2018. These searches yielded 11,500 results on Google Scholar and 1,270

results on PubMed. Studies that discussed applications of the state trait anxiety inventory outside of measuring anxiety in adults were excluded, yielding 25 results, eight of which were utilized.

Next, before writing the literature review of this capstone project on anxiety in DPT students, all search strings utilized prior were searched again, using the same databases and inclusion/exclusion criteria, during the week of February 7-14, 2022. This search yielded five new articles.

In addition, reference lists of included articles were also reviewed for potentially relevant studies. This process yielded an additional 20 articles; 13 of which had relevant information and were included in this literature review. Finally, the additional 23 articles reflected in the reference list include sources utilized to support topics in the introduction and to provide a rationale for ideas and definitions contained within this paper. Please refer to Table 1 for a summary of the literature searches and findings.

Table 1

Literature Searches and Findings

Dates	**Search terms**	**Databases**	**Initial #**	**Excluded**	**Utilized**
Feb-March, 2020 & April, 2021	Anxiety AND physical therapy students	PubMed Google Scholar	357 1,660,000	Non-academic settings, non-allied health students, experiences outside of class/clinic	24 4
Feb-March, 2020	Test-taking anxiety AND PT Stress-diathesis model	Google Scholar, PubMed Google Scholar, PubMed	17,000 5 17,500 7,218	Lacked test-taking component Implications of stress-diathesis model lacking	19 8
March-April, 2021	State trait anxiety inventory, “STAI”	Google Scholar PubMed	11,500 1,270	Non-adult population State trait anxiety not addressed	13
Final search conducted Feb, 2022 using same search terms and databases					5
Reference lists of included articles searched					13

Incidence and Prevalence of Anxiety in DPT Students

According to recent data, 265,000 physical therapists were practicing in the United States in 2019 (Physical Therapy, Data USA, n.d.). In 2020 there were 11,331 doctor of physical therapy degrees awarded in the United States from 261 accredited physical therapy schools (American Physical Therapy Association [APTA], Commission on Accreditation in Physical Therapy Education [CAPTE], 2021). Physical therapy programs in the United States currently require a Doctor of Physical Therapy (DPT) degree, which is typically completed in 5 years of undergraduate work plus 3 years of graduate study. During this time, DPT students are required to take and pass a considerable number of both written and clinical examinations. Furthermore, to obtain a professional PT license, graduating DPT students have a lifetime maximum of six attempts to pass the National Physical Therapy Exam, a computerized, multiple-choice test consisting of 250 questions (Federation of State Boards of Physical Therapy, 2020).

A recent large study by Bogardus et al. (2021) seeking to determine the incidence and severity of anxiety in DPT students in the United States sent surveys to 238 DPT programs in the United States yielding 1,238 participants. Although normative data indicates that a score of five represents the average level of anxiety based on a college sample, DPT participants in this study scored an average of 6.32 (SD = 6.29), $t(1,227) = 7.33$, $p \leq 0.005$ (Bogardus et al., 2021). Additional current literature (Ferreira et al., 2020; Kafeel et al., 2018; Macauley & Plummer, 2017) also suggests that DPT students experience greater anxiety than age-matched norms.

A study by Ferreira et al. (2020), which measured salivary cortisol levels and self-reported anxiety using the State-Trait Anxiety Inventory (STAI) before students took an objective structured clinical examination (OSCE), found trait anxiety scores in 32 Bachelor of Physical Therapy Students in Brazil was significantly higher than normative values ($p < 0.001$). Similarly,

in a cross-sectional study of 382 undergraduate PT students at Dow University of Health Sciences in Pakistan, Kafeel et al. (2018) reported that 40.1% of participants reported severe stress and 38.2% reported moderate stress. In addition, just 19.6% of students in this study reported mild stress, and 2.1% reported not having any stress (Kafeel et al., 2018).

Likewise, using a cross-sectional, descriptive survey study of 86 DPT students, Macauley and Plummer (2017) measured test-taking anxiety levels in DPT and found that 36% of the students surveyed scored in the moderately high, high, or extremely high-test anxiety category as measured by the Westside Test Anxiety Scale (WTAS). The score on the WTAS was most predicted by grade point average ($\beta = 1.39$, $p < 0.001$) and female gender ($\beta = 0.428$, $p < 0.019$) (Macauley & Plummer, 2017). Similarly, Thomas-Davis et al. (2020) examined stress and anxiety in 29 first-year occupational and physical therapy students using the Depression Anxiety Stress Scale-21 (DASS-21) and found that 50% of the females in the study and 44% of the males scored in either the mild or severe ranges of stress and anxiety as measured by the DASS-21.

Trait Anxiety

Freud (1924) was the first to categorize anxiety as trait anxiety or state anxiety. Trait anxiety is the collection of individual attributes that predisposes how an individual responds to stressful situations (Daviu et al., 2019; Lau et al., 2006). The influence of trait on anxiety is considered constant and part of an individual's personality (Macauley et al., 2018). When applying the stress-diathesis model to consider the origins of anxiety, the diathesis component reflects the underlying inherited attributes of a person, which constitutes this categorization of trait anxiety.

There is limited research specifically examining trait anxiety in DPT students. Some literature that has explored the relationship between anxiety in DPT students and either a

personal or family history of anxiety. Bogardus (2019) examined anxiety and depression in general in this population by surveying 1,238 DPT students equally distributed across the United States. The researchers collected demographic information and mental health information surrounding the issues of depression and general anxiety, including a family history of mental illness, as well as factors associated with increasing and decreasing their presence. This study also had a qualitative component in which 20 survey participants who self-identified as having a mental health disorder participated in individual interviews to explore topics surrounding the perceived causes of anxiety and factors that facilitated anxiety reduction (Bogardus, 2019). The Depression, Anxiety, and Stress Scale (DASS-42) was the self-report scale used to determine anxiety levels in this study. Bogardus (2019) found weak correlations ($p < 0.005$) between a family history of mental illness and a diagnosis or perception of a mental illness diagnosis and anxiety scores on the DASS-42.

Studies specifically examining the impact of race and inheritance on anxiety in DPT students could not be identified. However, a preliminary study ($n = 33$) examining first-year DPT students by Fabrizio et al. (2021) found a statistically significant relationship between race and academic performance ($p < 0.01$), with participants who identified as White having higher course grades than those who identified as non-White. In addition, a statistically significant relationship was found between race/ethnicity and self-efficacy ($p < 0.008$) with participants identifying as minorities scoring lower on a measure of self-efficacy, which was also found to negatively correlate with academic performance (Fabrizio et al., 2021).

Other studies have supported inheritance patterns for anxiety and mental health conditions. Prospective surveys suggest that mothers with increased anxiety during mid to late pregnancy have an increased risk of having children with emotional and behavioral problems

(Huizink et al., 2004; O'Connor et al., 2002; Van den Bergh & Marcoen, 2004). The underlying mechanisms are thought to be a combination of genetic inheritance and external influences.

Turner et al. (1987) examined anxiety in school-aged children and its connection to birth parents. They found that children with a family history of anxiety were more likely to be diagnosed with anxiety. This study did not attempt to determine the contributions of genetic inheritance versus environment. However, Rice et al. (2010) examined these distinctions and found positive associations in levels of anxiety between both related mother-child pairs ($\beta = 0.211$, $p = 0.01$) and unrelated mother-child pairs ($\beta = 0.207$, $p = 0.001$) highlighting the association of anxiety to environmental causes. Although evidence exists connecting anxiety within families, additional research is needed to determine whether a relationship exists between individuals and/or a family history of anxiety and anxiety in DPT students.

State Anxiety

In contrast to trait anxiety which describes an individual's predisposition to anxiety, state anxiety involves the individual experiencing acute emotions often caused by environmental stressors (Wiedemann, 2015). State anxiety often triggers signs of physiologic arousal due to the activation of the sympathetic nervous system, and involves symptoms of worry, apprehension, and tension (Lau et al., 2006; Speilberger, 1966). Roozendaal et al. (2008) described the hypervigilant response associated with state anxiety as a mechanism for avoiding future threats and for facilitating memory consolidation.

External environmental influences may be related to outside stress and/or support from preexisting life roles. Although research explicitly focusing on the relationship between support and levels of anxiety in DPT students is lacking, current studies link lower socioeconomic status (Eisenberg et al., 2007; Weitzman, 2004) with an increased risk of anxiety. Increased

relationship stressors (Blanco et al., 2008; Kisch et al., 2005) and/or low social support (Blanco et al., 2008; Hefner & Eisenberg, 2009) are also associated with poor mental health in college students.

After analyzing a survey study of DPT students, Bogardus (2019) reported that most DPT students describe their primary support system as someone whom they had a personal relationship with and that accessing professional help often increases stress. Consistent with this theme, Hunt and Eisenberg (2010) conducted a review of the literature examining college students' mental health and found that less than 20% of students with anxiety sought professional treatment. The most common barriers to treatment identified in the review were lack of insurance, lack of knowledge of available resources, and negative impressions of the effectiveness of psychological/mental health treatment. Similarly, Givens and Tjia (2002) reported that just 22% of medical students with severe depressive symptoms sought professional treatment. The most frequently reported barrier in this study was lack of time; the other barriers were consistent with those described by Hunt and Eisenberg (2010).

Considering that the stress component of the stress-diathesis model reflects the environmental triggers, situational circumstances, and external influences associated with state anxiety, different test-taking situations encountered in DPT school should be examined. DPT programs, known for their academic rigor, typically have assessments of physical performance to simulate clinical scenarios and frequent written examinations. Therefore, the impact of the type of test, and the physical testing environment, on anxiety should be examined in DPT students.

Stress Diathesis Model

Comparable to how an individual's predisposition contributes to trait anxiety and external influences are more responsible for state anxiety, the stress-diathesis model proposes that

disorders develop in persons who are genetically predisposed and experience environmental adversity (Kendler et al., 2002). Stress is known to disrupt a person's psychological equilibrium by creating exaggerated emotional responses (Oatley et al., 2006). "Diathesis" refers to the likelihood or predisposition of individuals to both physical and psychological conditions (Parenting for Brain, 2020). When stress, described by Lazarus and Folkman (1984), as the perception that environmental demands are threatening or exceeding resources, is coupled with a pre-existing vulnerability, the effects increase exponentially. When an individual has less predisposition for developing a condition, it will take more stress for the same condition to manifest. Consistent with this model, the perception of stress and anxiety in DPT students may be more prevalent in those predisposed to have anxiety, those who perceive the conditions associated with being a DPT student to be more threatening, and when the environment, such as when taking a certain type of exam, are described as more anxiety-provoking.

Written Examinations and Anxiety

State anxiety in DPT students is known to occur during test-taking situations (Ferreira et al., 2020; Kafeel et al., 2018; Zhang & Walton, 2018). Several studies have examined the conditions of written tests on anxiety levels. Tests that have a timed component (Eysenck et al., 2007; Keogh et al., 2004; Schwartz et al., 2015) are linked to increased levels of test-taking anxiety. To compare timed versus untimed testing during a PT gross anatomy exam, Schwartz et al. (2015) examined anxiety levels and academic performance between students who had timed tests and those without for 81 University of Toronto PT students. A modified State-Trait Anxiety Inventory (STAI) was used to measure anxiety in both groups after both types of tests. Students who took the untimed version took an average of 8 minutes longer, scored significantly higher ($p = 0.005$), and reported a significant reduction in anxiety ($p = <0.001$) on the STAI compared to

those who took the timed version. One theme reported from students in the untimed group was that the lack of time pressure created a more relaxed environment, which fostered self-confidence (Schwartz et al., 2015).

In a larger study of eighth-grade students, Elliot and Marquart (2004) also examined student reactions to timed versus untimed testing environments during a math test. Like the previously described study, students in the untimed group reported more favorable perceptions of the testing environment; however, there wasn't a significant difference in academic performance between the groups.

Dawood et al. (2016) also found moderate to severe levels of test anxiety, measured by the TAI, in 277 female undergraduate nursing students in Saudi Arabia. This study found a statistically significant relationship between reported levels of test anxiety and academic level ($r = -0.128$, $p = 0.03$) indicating those who completed more semesters experienced less anxiety. This finding is consistent with a study of medical students who also reported higher levels of test-taking anxiety in the earlier years of their education (Alkhalaf, 2018).

A study of 290 German high school students by Steinmayr et al. (2016) examined the relationship between subjective well-being, test anxiety, and academic achievement. Test anxiety was measured using a short version of the German Test Anxiety Inventory (TAI-G), which is a revised version of Spielberger's TAI scale. Academic achievement was measured by grade point average (GPA) and report card scores. Steinmayr et al. (2016) found a statistically significant inverse relationship between the worry component of test anxiety and academic achievement; participants who reported higher levels of test anxiety had lower achievement scores and lower GPAs than those reporting less.

These results supported findings described in a review study by Eysenck et al. (2007) that examined the literature on anxiety, testing, and performance through a theoretical lens to determine whether they were interrelated. Consistent with the attentional control theory, which proposes that as the demands of a situation increase, performance decreases in those with anxiety due to a lack of resources, Eysenck et al. (2007) identified four cognitive impairments occurring with test anxiety: (1) decreased ability to inhibit prepotent responses, (2) increased distraction, (3) impaired performance in dual-task situations, and (4) difficulty switching between tasks. However, despite these impairments, the researchers found that the quality of performance may not be impaired when effective compensatory strategies are utilized (Eysenck et al., 2007). Although this study was a review of existing literature containing participants outside of the target population, it provided a relevant theory to describe the phenomenon of test anxiety and proposed that appropriate strategies may be effective in reducing the effects.

Clinical Examinations and Anxiety

Tests that require a physical performance, known as objective structured clinical examinations (OSCEs) require the student to demonstrate both cognitive and physical aptitude. This type of exam typically provides a case-based history and requires the student to perform a physical examination of a standardized patient. Many healthcare professional curriculums include OSCEs to ensure students master the hands-on components of patient care to ensure patient safety and quality care. Because of the complex nature of this type of examination, students in the healthcare professions often report these tests as increasing both anxiety and preparation time (Brand & Schoonheim, 2009; Marshall & Jones, 2003; Nicholson & Forrest, 2009; Zhang & Walton, 2018).

Zhang and Walton (2018) conducted a qualitative study of 105 Ontario University PT students to determine which factors were perceived as anxiety-producing during OSCE examinations. Students in the study were asked to describe the top five causes of anxiety during an OSCE. Responses were then categorized into the following themes: social performance anxiety, fear of lacking competence, overvaluing the outcome, fear of the unknown, personal health and lack of coping resources, and operational or procedural influences (Zhang & Walton, 2018).

Similarly, Brand and Schoonheim (2009) used the STAI-S to compare anxiety states for dental students taking five different types of examinations, with one being an OSCE. This study found higher levels of anxiety reported by the students in the OSCE testing group compared to those taking a test without a physical component. Like the *fear of lacking competence* theme described by Zhang and Walton (2018), students in this study positively correlated anxiety with the feeling of being underprepared.

Similarly, Zhang and Henderson (2014) used the Spielberger Test Anxiety Inventory (TAI) to examine the relationship between test anxiety and academic performance during both OSCEs and written exams in 166 chiropractic students. The TAI, a self-report questionnaire, uses a 4-point Likert scale to report anxiety symptoms prior to, during, and after test taking. Two sub-scales of the TAI separate the worry/cognitive component from the emotional symptoms. Moderate to high levels of test anxiety were reported by 85% of participants. Total test anxiety, measured by TAI scores, had a small negative correlation ($R^2 = 6.7\%$, $p = 0.001$) for written exams and was not statistically a significant predictor of physical exam performance as measured by OSCEs. Multiple regression analysis found replacing the total TAI score with scores on the

worry and emotionality subscales, test performance could be more accurately predicted (R^2 = 15.9%) (Zhang & Henderson, 2014).

Identified Causes of DPT Student Anxiety

Contributors to anxiety identified by existing literature in professional healthcare students include female gender (Macauley & Plummer, 2017; Thomas-Davis et al., 2020; Zhang & Walton, 2018), family and/or personal history of anxiety (Bogardus, 2019), sleep deprivation (Ellison et al., 2020), fear of failure (Borgardus et al., 2021), social perfectionism (Borgardus et al., 2022), grade point average (Williams et al., 2018), and year in school (Rizzolo & Massey, 2020; Williams et al, 2018).

When examining test-taking anxiety, Zhang and Walton (2018) found higher TAI and emotionality scores in females than males scores; however, the worry subscale scores were similar. Similarly, Thomas-Davis et al. (2020) found higher stress scores reported on the DASS-21 by female occupational and physical therapy students when compared to their male counterparts. In this study, none of the males (n = 9) scored in the “extremely severe” category while 10% of the females (n = 20) did. However, the small sample size of this study must be considered when generalizing results. Unfortunately, the large study (n = 1,228) by Borgardus et al. (2021) examining depression and anxiety in DPT students did not describe the impact of gender on anxiety levels.

There is strong evidence that children of anxious parents are more likely to have anxiety (Lawrence et al., 2018; Micco et al., 2009; Sydsjo et al., 2018). The inheritance appears to be a combination of shared genes identified as causing anxiety and environmental mechanisms (Ahmadzadeh et al., 2019). Environmental considerations include maladaptive parenting, observations, and/or learned behaviors from anxious parents to children (Aktar et al., 2017;

Ginsburg & Schlossberg, 2002). The exact mechanism of transmission continues to be investigated and there are limited studies examining the impact of how a family and/or personal history of anxiety impacts anxiety levels in DPT students.

Bogardus et al. (2021) examined anxiety levels and year in school and found that anxiety in first-year DPT students was statistically higher ($p = 0.001$) than in the third-year students. Furthermore, anxiety had a positive relationship between GPA and anxiety meaning those with more anxiety tended to have a higher GPA. In addition, Williams et al. (2018) found that second-year students had higher scores for DASS-21 Depression ($p = .003$), DASS-21 Anxiety ($p = .027$), and DASS-21 Stress ($p = 0.016$), than students in their first semester within a DPT program.

Similarly, Rizzolo and Massey (2020) examined the impact of year in school on anxiety and depression in a study consisting of 79 health science graduate students in four different programs (OT, DPT, SLP, PA). This study utilized the Beck Depression Inventory, Brief Symptom Index, and Global Severity Index to measure anxiety and depression in the students at three different points in time and determined that anxiety and depression often fluctuate for this population throughout the first year of school and then declines.

On the other hand, Ellison et al. (2020) surveyed 59 DPT students enrolled at the Texas Woman's University-Houston, School of Physical Therapy using the 21-item Depression, Anxiety, and Stress Scale (DASS-21) did not find a correlation between the year in school and anxiety level. However, this study did report an inverse correlation between the anxiety score on the DASS-21 ($r = -0.467$, $p \leq 0.005$) and hours of sleep (Ellison et al., 2020).

The State-Trait Inventory (STAI)

To objectively measure the influences of anxiety as described by the stress-diathesis model, separate measures of the contributions of both trait and state anxiety are warranted. Although the Westside Test Anxiety Scale (WTAS) is a validated measure for test anxiety, it does not look at anxiety in non-test-taking conditions, which was also investigated in this study. On the other hand, the Depression Anxiety Stress Scale (DASS) measures anxiety as well as stress and depression in a baseline state but does not have a mechanism to capture the conditional circumstance of test taking. Therefore, the State-Trait Inventory (STAI), developed by Charles Spielberger in 1966, was selected because of its ability to capture both conditions.

The STAI is a validated self-assessment tool, with good internal consistency and test-retest reliability, that measures both state and trait anxiety (Fioravanti-Bastos et al., 2011; Spielberger, 1966). To individually assess trait and state anxiety, the STAI contains two self-report subscales, each consisting of 20 items, asking respondents questions about how they feel (Julian, 2011).

The S-Anxiety subscale (STAI-S) measures state anxiety by assessing the intensity of feelings the respondent is experiencing "at this moment" when reading through statements such as "I feel at ease," using a 4-point Likert scale: (1) "not at all," (2) "somewhat," (3) "somewhat," and (4) "very much so" (Julian, 2011). The subscale measuring trait anxiety, the T-Anxiety scale (STAI-T), asks respondents to consider "how they generally feel" when reading through statements such as "I am a steady person," with the same 4-point Likert scale responses described for the STAI-T. To score each subscale, item scores are added within both subscales to obtain each subset's total score with a range of possible scores ranging 20 to 80 with the higher scores indicating greater anxiety (Julian, 2011).

A study by Zingano et al. (2019) established a cut-off score of > 53 on the STAI-T to have approximately 80% (44.4 – 97.7) sensitivity and 60% (46.5 – 68.6) specificity for detecting anxiety disorders in persons with drug-resistant Mesial Temporal lobe epilepsy with hippocampal sclerosis. However, the sample size in this study was small and the study population differed from this study. Additional studies, describing cut scores and normative values for the study population were lacking.

A cut score of 39-40 was reported by Knight et al. (1983) and Addolorato et al. (1994) to detect clinically significant symptoms for the STAI-S subscale. The STAI manual published by Spielberger (1983) reports a mean score for 531 female college students for the STAI-S as 38.76 (SD = 11.94, $\alpha = 0.93$) and 40.40 for the STAI-T (SD = 10.15, $\alpha = 0.9$). The same manual reports a mean STAI-S score for 324 male college students as 36.47 (SD = 10.02, $\alpha = 0.91$) and 38.30 for the STAI-T (SD = 9.18, $\alpha = 0.90$). Reported test-retest reliability coefficients during initial development ranged from 0.31 to 0.86 with intervals ranging from 1 hour to 104 days. Reported internal consistency alpha coefficients range from 0.86 to 0.95.

The STAI was chosen for this study because of its ability to distinguish between state and trait anxiety, its ease of use, and its psychometric properties. Several studies investigating anxiety in DPT students found elevated scores on the STAI when compared to age-matched peers (Ferreira et al., 2020; Frank & Cassidy, 2005; Macauley & Plummer, 2017). However, studies utilizing the state portion of the scale at two different points in time to specifically examine the effect of different test situations on anxiety were not found.

Anxiety Management Strategies

Although there is limited existing literature examining anxiety management strategies for DPT students, existing studies have identified exercise (Broman-Fulks et al., 2004; De Moor et al., 2006; Williams et al., 2018), music (Rayle & Chung, 2008), mindfulness-based training (Barbosa et al., 2013), and socializing (Williams et al., 2018) as effective methods of reducing anxiety.

A study by Thomas-Davis et al. (2020) measuring stress and anxiety in occupational therapy students and DPT students reported that the most used stress reduction strategies were both talking with friends (76%) and listening to music (76%), followed by engaging in fun activities, exercise (62%), prioritizing and planning ahead (52%), and drinking (24%). However, this study did not describe statistical relationships between objective anxiety scores for those with anxiety reduction strategies to determine which are most effective.

Similarly, Williams et al. (2018) surveyed 163 DPT students from two different programs in Southwestern United States about anxiety, stress, and coping mechanisms. When participants were asked how often they engaged in a list of anxiety activities, 95% reported exercising during the past week, followed by socializing (75%), watching TV (70%), listening to music (64%), sleeping (64%), engaging in social media (56%), eating (55%), and drinking alcohol (50%). However, this study reported that students tended to reduce how much time they spend engaging in their anxiety reduction strategies as the semester progressed and that this negatively impacted levels of stress and anxiety as measured by the DASS-21.

A study by Barbosa et al. (2013) examining the use of mindfulness-based stress reduction training included eight 2.5-hour weekly classes plus an 8-hour silent day-long retreat for graduate healthcare students from five different programs, including DPT students. This

intervention was found to reduce anxiety at weeks eight ($p < 0.001$) and 11 ($p < 0.01$), when compared to baseline scores, using the Burns Anxiety Inventory. Although additional studies examining mindfulness training in DPT students were not identified, the finding of Barbosa et al.'s (2013) study are like those of prior mindfulness training studies that have found mindfulness interventions effective in reducing anxiety for nurses (Cohen-Katz et al., 2005) and medical students (Rosenzweig et al., 2003).

Studies suggest that a positive student-faculty relationship can improve academic performance (Christe, 2013) and increase student retention (Lamport, 1993; Shelton, 2003). However, the impact on anxiety levels has not been reported. Qualitative comments conducted in Bogardus' (2019) study of DPT students indicated that DPT students described approachable faculty members as "sincere, accepting, welcoming, helpful/supportive and genuine" (p. 128). Similarly, a review study by Lamport (1993) found that students with increased faculty interactions tended to perform better than those with less, and that increased "helpful" contact with faculty members improves altruism and overall college satisfaction. Bogardus and Patel's (2019) study suggested that additional research specific to the potential influence of faculty interaction on test anxiety is warranted.

As mentioned, there are many studies illustrating elevated levels of anxiety in DPT students, and it is well-established that sustained anxiety can have negative consequences. What is not clear from existing studies is the personal and/or environmental factors that most contribute to anxiety in DPT students.

Gaps in the Literature

Although there is a plethora of literature indicating that anxiety levels in DPT students are elevated, there is limited research definitively identifying the underlying causes. There is

limited research examining whether taking tests elevates anxiety and what conditions associated with test-taking cause the most anxiety, especially within the target population of DPT students. Because of the rigorous nature of the DPT curriculum, it is unclear whether findings from a general population of college students transfer to DPT students. In addition, most of the anxiety measures used within the studies were self-report. Although implied inferences can be drawn between the stress-diathesis model and what aspects of heredity and environment may contribute to test anxiety, only one study explicitly examined this relationship in DPT students, and this study did not specifically examine test-taking anxiety. In addition, most of the studies reviewed lacked randomization and control groups, which decreases the impact of the results. Finally, only a few studies examined anxiety management strategies and their effectiveness.

In summary, when considering the application of the stress-diathesis model to explain anxiety in DPT students, it seems there is variable evidence to describe some aspects while other components have gaps in the literature. Although multiple studies support that inheritance accounts for generalized anxiety, there is limited research describing this connection specific to DPT students and test anxiety. Multiple studies link environmental conditions such as the type of test and whether it is timed with test anxiety but its relationship with academic performance is unclear.

The objective of this study is to address these gaps to improve the understanding of which attributes and situations contribute to anxiety in DPT students. In addition, it will examine factors that may reduce anxiety such as exercise, socializing with friends and family, and listening to music, as suggested by the current literature. In addition, the state portion of the STAI (STAI-S) will be utilized in a repeated measures design to examine how external

influences, such as the type of test, impact anxiety in DPT students. The methods for the study are described next in Chapter 3, Methods.

Chapter 3

Methods

This study examined the influence of personal and environmental factors on anxiety in Doctor of Physical Therapy (DPT) students. Specifically, this study examined the impact of race, gender, year in the program, grade point average (GPA), socioeconomic status, having a personal or family history of anxiety, and the practice of utilizing management strategies, on anxiety, which was objectively measured by the State-Trait Anxiety Inventory (STAI). In addition, participants were randomized into two groups, written (W) and practical (P), to determine whether the level of situational anxiety, as measured by the STAI-S, varies depending on the type of assessment a DPT student encounters. Please refer to Chapter 1, page 17 for all research questions and hypotheses guiding this study.

Location

The study was completed at Neumann University (NU), a small Catholic Franciscan University located in Aston, Pennsylvania, a small town in the northeast corridor of the state. The DPT program at NU is accredited by the Commission on Accreditation in Physical Therapy Education (CAPTE) and consists of 95 credits taken in 3 years over the course of 30 weekends with courses taking place in person on campus.

Study Design

This quantitative, quasi-experimental study utilized two instruments and two data collection periods with two phases. The first phase of the study, the pilot phase, took place during the fall of 2021 and consisted of 52 participants. The current study, which utilized the same methodology as described for the pilot study, took place in July 2022, and included 44 participants. First, the data collection instruments (Appendix A), including the data collection

questionnaire and the State-Trait Anxiety Inventory (STAI), are described. Next, the methodology and results of the pilot study are described, followed by an explanation of the methodology for this study, including a detailed description of the instruments, coding, and statistical analysis.

Study Background

Before the completion of this study, a pilot study was conducted during the fall of 2021 by the primary investigator, Heather Anderson, along with a group of five graduate DPT students from Neumann University. Next, only the primary investigator continued to collect data during the summer of 2021. These findings are described in the results section of this manuscript. The methodology and study instruments for both the pilot and this study were the same.

Before collecting data for the pilot study, all investigators conducted a review of the literature examining anxiety in DPT students. Once each investigator completed a review of the literature, the investigators discussed the gaps in the literature to develop the goals of the research study and determine which instruments would be most effective in collecting the information needed to answer the research questions.

Pilot Study

The pilot study took place during the fall of 2021 and consisted of two data collection sessions, which both occurred on campus at NU. The first data collection session measured baseline state and trait anxiety using the STAI-S and STAI-T, and collected demographic information, as well as participant perception of anxiety causes and management strategies, using the data collection questionnaire (Appendix A). The second data collection session measured state anxiety again using the STAI-S electronically as a survey on Blackboard, 30 minutes before the participants took either a written (W) or practical (P) exam.

Pilot Study Target Population

The target population for both the pilot study and the current study consisted of DPT students in the United States. According to CAPTE, during the 2019 academic year, a total of 34,202 PT students were enrolled in physical therapy programs in the United States (Commission on Accreditation in Physical Therapy Education, 2020). To achieve statistical significance, with a confidence level of 95%, a sample of 8,116 PT student participants was needed. The total target population for data collection was 57. Combining these responses with the responses from the pilot study will result in a maximum potential combined sample size of 111.

The sample population during the pilot study consisted of all NU DPT students enrolled during the fall of 2022 who met the inclusion criteria. The inclusion criteria required that participants were enrolled in the NU DPT program, were willing to participate in the study as evidenced by signing the consent form (refer to Appendix C), and could not have provided feedback for the pilot data collection questionnaire.

Pilot Study Sample Size

The goal for the pilot study was to study all eligible Neumann DPT students during the fall of 2021. The eligible sample population for the pilot study was 84 DPT students. This number consisted of 35 first-year students, 33 second-year students, and 31 third-year students, minus 15 third-year students who provided feedback for the pilot data collection questionnaire.

Pilot Study Sample Recruitment

After receiving IRB approval (# 2021-13-135) on September 21, 2021, study participants were recruited using a sample of convenience. The primary investigator recruited students by emailing them at two different points in time, posting announcements on Blackboard, and

announcing the study to the second and third-year classes in person. Students were incentivized to participate in the study by receiving 1 hour toward their service-learning project. All students at Neumann University are required to complete 20 hours of service learning before graduating.

Pilot Study Data Collection

Pilot study data collection occurred between September 25 and October 16, 2021. Before data collection, the primary investigator coded 60 packets for potential study participants, which consisted of both versions of the STAI (STAI-S and STAI-T), the consent form, as well as the data collection questionnaire. All materials within one packet were coded with the four-digit unique, randomly generated, subject identifier code. Participants gathered after class on campus at NU to participate in the study. After each participant completed the consent form, it was separated and placed in a secured envelope to protect privacy and prevent the researchers from matching the participant to their data. Once the consent form was completed, a member of the research team would make sure the participant answered all questions on both subscales of the STAI as well as the data collection instrument. The investigator then placed these completed instruments in a folder separate from the one containing the consent forms. Before any participants left the room, they were prompted to take a picture of their unique study identifier and told whether they were in the written group or the practical exam group for the follow-up STAI-S survey. Consent forms were stored separately from research data in a locked file cabinet behind a locked door in the primary investigator's office.

Participants with an even birth month were stratified to the practical exam group (P) and those with an odd birth date to the written exam group (W). For the second data collection during phase one, the pilot study, participants were instructed to complete the STAI-S a second time electronically on Blackboard within 30 minutes of taking their next written or practical

assessment. The State portion of the STAI (STAI-S) was set up as a survey with the "PT Program Home Page" course. To match the results to the second STAI-S to the first, participants were required to enter their unique identifier code within this survey. The primary investigator was the only research team member with a list of identifier codes matching participant names. The information was used to match up participants who completed with second STAI-S without entering their identifier number. There were three instances where this was required.

Pilot Study Results

There were 52 participants in the pilot study. The majority (n = 25) were second-year students, followed by 17 first-year and 10 second-year students. The median age of the participants was 26 years old (range 23-43) and most identified as being White (83%) and female (56%). GPA ranged from 3.0-3.9 with a median of 3.6. The average number of hours worked per week was 20 hours with 11.5% not working at all, 39% working less than 20 hours, and 21% working more than 30 hours per week. The most reported (42%) range of income was >$75,000, and the average number of additional life roles, in addition to being a student, was two. Fifty-three percent of participants reported being first-generation graduate students.

Almost all participants (90%) reported experiencing anxiety before being in DPT school, 58% reported a history of test-taking anxiety, and 59% reported having a parent/guardian with a history of anxiety. When asked to quantify anxiety, using a Likert scale, in different test-taking situations, participants reported experiencing the most anxiety when taking a comprehensive exam, as compared to written or practical exams. Most (85%) participants reported having at least one anxiety management strategy. Exercise was the most reported, followed by relaxation and talking with a friend.

The mean baseline STAI score for the STAI-S was 39. This number increased to 53 for both the written and practical exam groups when taken a second time 30 minutes prior to an examination. The average score for the STAI-T, taken only once during the initial data collection, was 43.

As hypothesized, female participants and those reporting a history of parent/guardian anxiety, had both higher STAI scores, both at baseline, and 30 minutes prior to taking an examination. Also consistent with the hypothesis, older participants reported less anxiety, and there was a significant increase in STAI-S, compared to a baseline measure when taken again 30 minutes prior to any type of examination.

Contrary to the hypothesis, DPT students with more life roles had lower STAI scores as did those who reported working more hours. Furthermore, unlike the hypotheses, persons identifying as a minority and those participants reporting anxiety reduction strategies did not have lower STAI scores. Finally, participants' self-reporting anxiety did not have higher STAI baseline scores as expected.

Instruments and Measures

The primary instrument for this study, the data collection questionnaire, was designed and piloted prior to the initial data collection conducted during the pilot study. The data collection questionnaire (refer to Appendix A) was designed to capture the individual characteristics of participants to determine what impact, if any, they have on anxiety. This collection instrument was designed during the summer of 2021 and piloted to 15 members of the target population during that time. After discussing the feedback from the pilot reviewers, the primary investigator incorporated several recommended changes to make the instrument easier to

read. The final version of this form utilized in the pilot study consisted of three sections and 26 items (refer to Appendix A).

Completion of the data collection instrument took less than 10 minutes. The first section of the data collection questionnaire collected basic demographic information such as gender, age, and year of study. The second section used a 5-point Likert scale to evaluate how much anxiety was experienced during written, practical, and comprehensive examinations and included inquiries about baseline levels of anxiety and life roles. The third section collected information about anxiety management strategies and used a 5-point Likert scale to collect information about how much external support the participant received regularly (1 = No support, 2 = Slight support, 3 = Some support, 4 = Moderate support, 5 = Extreme support).

The second instrument utilized in this study was the State-Trait Anxiety Inventory (STAI), a validated measure used to objectively measure two different components of anxiety, state (STAI-S) and trait (STAI-T). The STAI was first developed in 1966 by Dr. Charles Spielberger and then revised in 1983 (Julian, 2011). Before selecting this instrument, several validated instruments for objectively measuring anxiety were compared to determine which was the best fit for the research project. These instruments included the Hamilton Anxiety Rating Scale, the Test Anxiety Inventory (TAI), and the STAI. Because the STAI has two components, the State and Trait, designed to examine both the predisposition to anxiety (STAI-T) as well as the amount of anxiety experienced during a specific moment in time (STAI-S), which aligned well with the stress-diathesis model guiding this study, this instrument was utilized for the study. To secure permission to use this STAI, Mind Garden, Inc., the company with the intellectual rights to this tool, was contacted (refer to Appendix B). The rights to use 160 copies of this

measure, as well as the scoring sheets were purchased by the primary investigator on July 2, 2021.

The STAI was then used to objectively measure anxiety, the primary dependent variable for this study, which was categorized as either trait (STAI-T) or state (STAI-S). Scores for both scales, which consist of 20 questions each, were recorded for each participant at baseline, and then the STAI-S score was recorded a second time electronically within 30 minutes of taking either a written or practical examination. Completion of each section of the STAI took between two and ten minutes at baseline and less than 5 minutes for the STAI-S the second time. STAI items on both subscales were scored using a 4-point Likert scale, which varies slightly for each subscale.

For the STAI-S respondents were asked to indicate how they feel "right now" in response to 20 statements such as "I feel at ease," using a 4-point Likert scale (1 = Not at all, 2 = Somewhat, 3 = Moderately so, 4 = Very much so). For the STAI-T, respondents were asked to indicate how they "generally feel" in response to statements such as "I am a steady person," using a 4-point Likert scale (1 = Almost never, 2 = Sometimes, 3 = Often, 4=Almost always) (Spielberger, 1983). STAI item scores were added to obtain a subset total score with reverse scoring for anxiety-absent items (19 items of the total 40 across both scales). The range of scores for each subset is 20-80, with a higher score indicating more anxiety.

Independent variables were captured on the data collection instrument and included whether the participant or their parents/guardians have a history of anxiety, the average number of hours per week worked, gender, race, year of study, income level, life roles, strategies for anxiety reduction, and the amount of perceived external support. Table 2 provides specific

details about how each variable from both instruments was coded during the pilot study for eventual data entry into SPSS.

Table 2

Instrument Variables and Coding

Variable	Question on Data Questionnaire	Item Score	Variable Type	Data Analysis
Demographic	Q1 (Gender): 5 items	1=Male 2=Female 3=non-binary 4=Other 5=Prefer not to answer 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Demographic	Q2 (Race): 8 items	1=White 2=Black 3=Hispanic 4=Asian 5=Native American 6=Pacific Islander 7=Other 8=Prefer not to answer 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Demographic	Q3 (Age): 1 item	Numerical	Independent, Continuous	Descriptive statistics
Demographic	Q4 (Year of Enrollment DPT): 4 items	1=First year 2=Second year 3=Third year 4=Prefer not to answer 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Demographic	Q5 (GPA): 1 item	Numerical	Independent, Continuous	Descriptive statistics
Socioeconomic	Q6 (Average # Hours Worked per Week): 1 item	Numerical	Independent, Continuous	Descriptive statistics
Socioeconomic	Q7 (Household Income): 6 items	1=Less than $15,000 2=$15,000-$25,000 3=$25,001-$35,000 4=$35,001-$50,000 5=$50,001-$75,000 6=$75,001 or more 99=Not answered	Independent, Categorical, Ordinal	Descriptive statistics

Demographic	Q8a (Education for Parent/Guardian #1): 6 items	1=Did not finish HS 2=Finished HS 3=Associate Degree 4=Bachelor's Degree 5=Master's Degree 6=Graduate/Professional Degree 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Demographic	Q8b (Education for Parent/Guardian #2): 6 items	1=Did not finish HS 2=Finished HS 3=Associate Degree 4=Bachelor's Degree 5=Master's Degree 6=Graduate/Professional Degree 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Psychosocial	Q9 (Family Anxiety): 4 items	1=Yes 2=No 3=Unsure 4=Prefer not to answer 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Psychosocial	Q10 (First Generation Grad Student): 3 items	1=Yes 2=No 3=Other 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Psychosocial	Q11 (Number of Life Roles Reported): 1 item	Numerical	Independent, Continuous	Descriptive statistics
Psychosocial	Q12 (Prior Anxiety): 3 items	1=Yes 2=No 3=Prefer not to answer 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Psychosocial	Q13-16: 5 items per question Questions about amount of worry specific scenarios	1=Not at all worried 2=Slightly worried 3=Somewhat worried 4=Moderately worried 5=Extremely worried	Dependent, Continuous	Descriptive and Inferential Statistics
Psychosocial	Q17 (What makes you most nervous): 1 item	Open-ended response	Qualitative	Categorization of qualitative themes
Psychosocial	Q18 (Physical Symptoms): 1 item	Open-ended response	Qualitative	Categorization of qualitative themes

Psychosocial	Q19 (Perceived sources of anxiety): 1 item	Open-ended response	Qualitative	Categorization of qualitative themes
Psychosocial	Q20 (Anxiety Management): 2 items	1=Yes 2=No 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Psychosocial	Q21 (List Management Strategies): 1 item	Open-ended response	Qualitative	Categorization of qualitative themes
Psychosocial	Q22 (Test Anxiety): 2 items	1=Yes 2=No 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Psychosocial	Q23 (Specific Anxiety Management): 2 items for each response	1=Yes 2=No 99=Not answered	Independent, Categorical, Nominal	Descriptive statistics
Psychosocial	Q24 (External Support): 5 items	1=No Support 2=Slight Support 3=Some Support 4=Moderate Support 5=Extreme Support	Dependent, Continuous	Descriptive and Inferential Statistics
Psychosocial	Q25 (Additional Management Strategies): 1 item	Open-ended response	Qualitative	Categorization of qualitative themes
Psychosocial	Q26 (Additional Comments for Study): 1 item	Open-ended response	Qualitative	Categorization of qualitative themes
STAI-State (Y-1)	Q27 STAI-S baseline score: 1 item	Numerical	Dependent, Continuous	Descriptive and Inferential statistics
STAI-Trait (Y-2)	Q28 STAI-T baseline score: 1 item	Numerical	Dependent, Continuous	Descriptive and Inferential statistics
Written or Practical group	Q29 Written or Practical group: 1 item	1 = Written group 2 = Practical group	Independent, Categorical	Descriptive and Inferential statistics
Repeated Measures STAI-S score	Q30 STAI-S repeated score: 1 item	Numerical	Dependent, Continuous	Descriptive and Inferential statistics

Study Overview

This study utilized the same instruments and followed the methodology described previously for the pilot study, but was conducted only by the primary investigator, Heather Anderson. Data collection commenced following joint IRB approval between Neumann and Radford University, on July 19, 2022. The sample population included students in their first semester of DPT school, which was a population that was not studied in the pilot due to the timing of the study, as well as all eligible second- and third-year students. Data collection took place between July 23, 2022, and August 7, 2022. It included both a baseline session, which was conducted in person at Neumann University and a follow-up online survey in which the participant completed the STAI-S on Blackboard a second time within 30 minutes of either a written or practical exam, depending on which group they were assigned.

Current Study Target Population

The target population for both the pilot and the current study consists of DPT students in the United States. According to CAPTE, during the 2020 academic year, a total of 36,841 PT students were enrolled in physical therapy programs in the United States (Commission on Accreditation in Physical Therapy Education, 2021). To achieve statistical significance, with a confidence level of 95%, a sample of greater than 8,200 participants was needed. To make the completion of this study feasible, it was known ahead of time that the sample size would not meet statistical significance. However, unlike the pilot study, this study examined DPT students during their first semester, which has been shown to be the most anxiety-provoking. In addition, the results of this study should provide useful information for the faculty at the NU DPT program and provide an established methodology to guide future larger studies.

The sample population for the current study consisted of all NU DPT students enrolled during the summer of 2022 who met the inclusion criteria. The inclusion criteria required that participants were enrolled in the NU DPT program, were willing to participate in the study as evidenced by signing the consent form (refer to Appendix C) and did not participate in the pilot study prior.

Current Study Sample Size

The goal for the current study was to study all eligible Neumann DPT students during the summer of 2022. Like the pilot study, this sample was a sample of convenience of eligible NU DPT students. Those eligible for the study included 35 newly enrolled first-year students who began the NU DPT program on May 21, 2022. In addition, there was a total of 22 currently enrolled NU DPT students eligible who did not participate in the pilot. The total target population for data collection was 57.

Current Study Sample Recruitment

Once the Radford and Neumann University IRB committees approved the study, the primary investigator recruited NU DPT students by emailing them and personally extending the offer to the students she taught during the summer semester. In addition, all NU DPT faculty were aware of the study and reminded students verbally during class on data collection days. Students were incentivized to participate in the study by receiving 1 hour toward their service-learning project and by being eligible for a randomized drawing of a $50 Visa gift card. In addition, the primary investigator provided food during the initial, in-person data collection sessions.

Current Study Data Collection

Data collection for this study utilized the same instruments and measures and followed the same methodology as previously described for the pilot study. Before the initial in-person data collection, the primary investigator coded 57 packets for potential study participants, which consisted of both versions of the STAI (STAI-S and STAI-T), the consent form (Appendix C), as well as the data collection questionnaire (Appendix A). All materials within each packet were labeled with a four-digit, unique, randomly generated, subject identifier code. Participants gathered during their lunch breaks as well as after class the weekend of July 23 and 24 as well as July 30 and 31 on campus at NU to complete the initial intake forms to participate in the study.

During the data collection sessions, once a participant completed the consent form, it was separated and placed in a secured envelope to protect privacy. The primary investigator placed the completed forms in a folder separate from the one containing the consent forms and stored them separately within locked cabinets in her office. Before any participants left the data collection session, they were prompted to take a picture of their unique study identifier and told whether they were in the written group or the practical exam group for the follow-up STAI-S survey.

Like the pilot study, participants with an even birth month were stratified to the practical exam group (P) and those with an odd birth date to the written exam group (W). For the repeated measures data collection session, participants were reminded several times via email to complete the STAI-S a second time electronically, on Blackboard, within 30 minutes of taking either a written or practical assessment. The same electronic survey used during the pilot study, which contains the State portion of the STAI (STAI-S), located on the PT Program Blackboard page, was utilized for the second data collection. On the survey, participants were asked to enter their

unique identifier code within the survey to link the results to the other data collected. The primary investigator maintained the list of identifier codes matching participant names and used it to remind participants to complete the follow-up survey. Once all follow-up surveys were completed, this list was deleted to maintain privacy.

Data Analysis

Results were calculated for 44 participants in this study as this was the number of participants who completed most questions. However, nine of the participants did not complete one or more of the questions, and five did not complete the repeated measure STAI-S within 30 minutes of an exam. The data from this study was coded the same way as described prior (refer to Table 2, page 49) for the pilot study. Data analysis of this set examined both demographic characteristics that influence anxiety as well as correlations between reported personal and family history of anxiety, whether practical or written exams seem to increase anxiety and relationships between life roles and reported levels of external support and anxiety levels.

Specifically, to investigate some components of the first research question, "RQ1: Is there a statistically significant relationship between DPT students' scores on the STAI and their gender, racial identity, year in the DPT program, and income level, hours worked per week, and/or educational level of parents/guardians?" the independent categorical variables of gender, race, year in the program, and income were analyzed using a two-way, mixed model ANOVA with the dependent continuous variable of STAI score, both baseline, and pre-test, to examine differences between baseline and follow up STAI-S.

A two-way mixed model ANOVA test was used because it is designed to determine whether there are any statistically significant differences between the means of two or more unrelated variables in a repeated measures design. In this study, it tested for differences between

the STAI score, both at baseline and before a test, which is a continuous variable between 20 and 80, and the independent categorical variables of gender, race, year in program, income, and parent/guardian education.

To examine another component of the first research question, which asked whether there was a relationship between the educational level of both participants' parents and STAI-S scores, three-way (2x2x2) ANOVAs were utilized. This test was utilized separately in two tests to examine the relationship between three variables, in this study, the variables were the educational level of both parent/guardian number one, parent guardian number two, and the dependent variable of baseline STAI-S score. Next, separately another three-way ANOVA was run to examine the relationship between repeated measures STAI-S score and the educational level of both parents/guardians.

To examine whether there was a relationship between age, and separately the number of hours worked, and STAI score, both components within the first research question, a Pearson Correlation coefficient was used. The relationship between the continuous baseline STAI-S, STAI-T, and then the repeated STAI-S scores, and age was examined in three separate Pearson Correlation coefficient tests. This process was repeated using the same inferential statistical test for hours worked, another continuous, independent variable, and STAI scores.

Pearson's Correlation Coefficient measures the statistical relationship between two continuous variables by examining the linear correlation which shows the strength and direction of a relationship. This relationship is measured by a number between -1 and 1, with zero showing no association between variables, 1 showing a perfect positive relationship, where both variables increase to the same amount, and -1 showing a perfect inverse relationship, when one variable increases the other decreases the same amount.

Because research question one included both STAI-S baseline, STAI-T, and repeated STAI-S scores, separate Independent Samples t-Tests were used to examine whether there were relationships between the STAI-T and gender, racial identity, year in DPT, income, personal history of anxiety and/or a family history of anxiety. In this study, the STAI-T was the continuous, dependent variable and the independent, categorical variables were gender, race, year in DPT, income, and personal and/or family history of anxiety.

The Independent Samples t-Test compares the means of two independent groups to determine whether there is statistical evidence that the means are significantly different. In this study, the STAI-T score, which was only measured at baseline, was the dependent variable, and the independent categorical variables of gender, race, income, educational level of parents, personal history of anxiety, and/or family history of anxiety were all compared in separate Independent Samples t-Tests to look for relationships.

To answer the second research question, “Is there a statistically significant difference between the amount of anxiety, as measured by the STAI-S score, for DPT students taking a written or practical examination within the next 30 minutes?” the means of the variables containing the scores of anxiety levels, as measured by the STAI-S at baseline and then the repeated STAI-S for both the written and the practical test group of participants, were compared using a two-way, mixed model ANOVA, with the dependent continuous variable of STAI-S score, both baseline and repeated, to examine differences between baseline and follow up STAI-S within the written and practical groups.

To answer the third research question, “Do DPT students with more life roles experience greater anxiety, resulting in statistically significant higher STAI scores than those with fewer life

roles?" a Pearson's Correlation Coefficient test was used because both the STAI scores and the number of life roles are both continuous variables.

Research question four "Do DPT students who report currently being anxious score higher on the STAI?" was measured using a Spearman rho correlation test to examine the relationship between the continuous variable of the baseline STAI-S, repeated STAI-S, and STAI-T scores separately, and the amount of "daily worry" reported by the participant which was measured on a 1-5 continuous Likert scale with one indicating "not at all" and 5 indicating "extremely." The Spearman rho correlation test was used because it measures ranked values for each variable and the amount of worry was ranked on a 1-5 continuous scale.

Research question five "Do DPT students with a personal history of anxiety or a parent/guardian with a history of anxiety have greater anxiety, as measured by the STAI?" and six "Do DPT students who report anxiety management strategies score lower on the STAI? If so, which strategies appear most effective?" were answered by running Independent Samples t-Test using the independent categorical, dichotomous (yes/no) variables of reported current anxiety, history of anxiety, parent history of anxiety and whether the management strategies are used (yes/no), respectively, against the STAI score, a dependent continuous variable.

In addition, to determine whether one type of anxiety management strategy was more effective than another, the eight strategies that were listed on the data collection form were individually coded by each participant's dichotomous response as either "yes" or "no." Next, the repeated measures STAI-S score taken within 30 minutes of an exam, along with the dichotomous, independent variable indicating whether or not the strategy was used was measured using Independent Samples t-Tests.

Basic demographic statistics about mean age, STAI-S, repeated STAI-S, STAI-T scores, percentages of gender, race, class cohort, and income, were determined using SPSS for each demographic variable column. To determine correlations and relationships between them inferential statistics, as previously described were utilized. The open-ended questions about anxiety were assessed using a deductive qualitative analysis and the findings were grouped into themes. For a complete explanation of the statistical tests utilized for data analysis to assess the research questions and hypothesis please refer to Table 3 below. This table describes the methods used for statistical analysis.

Table 3

Research Question Data Analysis

RQ1: **Is there a statistically significant relationship between DPT students' scores on the STAI and their gender, racial identity, age, year in the DPT program, income level, hours worked per week, and/or the educational level of parents/guardians?**

#	Hypothesis	IV(s)	IV(s) Data	DV(s)	DV(s) Data	Test
$H1.1_A$	Female gender increases STAI score	Gender	Categorical	STAI	Continuous	Two-way mixed ANOVA
$H1.2_A$	Minority participants will have higher STAI score	Race	Categorical	STAI	Continuous	Two-way mixed ANOVA
$H1.3_A$	Age is inversely related to STAI score	Age	Continuous	STAI	Continuous	Pearson's Correlation
$H1.4_A$	Year in DPT inversely related to STAI score	Year in DPT	Categorical	STAI	Continuous	Two-way mixed ANOVA
$H1.5_A$	Income is inversely related to STAI score	Income	Categorical	STAI	Continuous	Two-way mixed ANOVA
$H1.6_A$	Working more hours increases STAI score	Hours worked	Continuous	STAI	Continuous	Pearson's Correlation
$H1.7_A$	Parent education inversely related to STAI score	Parent education	Categorical	STAI	Continuous	Three-way ANOVA

RQ2: **Is there a statistically significant difference between the amount of anxiety, as measured by the STAI-S score, for DPT students taking a written or practical examination within the next 30 minutes?**						
#	**Hypothesis**	**IV(s)**	**IV(s) Data**	**DV(s)**	**DV(s) Data**	**Test**
$H2_A$	Practical exams increase STAI-S score more than written	Practical exam	Categorical/ Dichotomous	STAI-S	Continuous	Two-way mixed ANOVA
RQ3: **Do DPT students with more life roles experience greater anxiety, resulting in statistically significant higher STAI scores, than those with less life roles?**						
#	**Hypothesis**	**IV(s)**	**IV(s) Data**	**DV(s)**	**DV(s) Data**	**Test**
$H3_A$	More life roles increases STAI score	Life roles	Continuous	STAI	Continuous	Pearson's correlation
RQ4: **Do DPT students who report currently being anxious score higher on the STAI?**						
#	**Hypothesis**	**IV(s)**	**IV(s) Data**	**DV(s)**	**DV(s) Data**	**Test**
$H4_A$	High reported anxiety increases STAI score	Reported anxiety	Categorical	STAI	Continuous	Spearman rho
RQ5: **Do DPT students with a personal history of anxiety or a parent/guardian with a history of anxiety have greater anxiety, as measured by the STAI?**						
#	**Hypothesis**	**IV(s)**	**IV(s) Data**	**DV(s)**	**DV(s) Data**	**Test**
$H5.1_A$	History of anxiety increases STAI score	History of anxiety	Categorical/ Dichotomous	STAI	Continuous	Independent Samples t-Test
$H5.2_A$	Parent/guardian with anxiety increases STAI score	Parent history of anxiety	Categorical/ Dichotomous	STAI	Continuous	Independent Samples t-Test
RQ6: **Do DPT students who report anxiety management strategies score lower on the STAI? If so, which strategies appear most effective?**						
#	**Hypothesis**	**IV(s)**	**IV(s) Data**	**DV(s)**	**DV(s) Data**	**Test**
$H6_A$	Management strategies decreases STAI score	Management strategies	Categorical/ Dichotomous	STAI	Continuous	Independent Samples t-Test

Limitations

The data collection questionnaire, used to collect information about the independent variables, was created by the primary investigator and co-investigators study before the pilot study. Although the instrument was piloted by people in the study population and then revised accordingly, this instrument has not undergone expert review to establish content validity. In addition, because the findings reflect only Neumann University DPT students, the results may not be generalizable to other DPT students enrolled at other institutions.

Delimitations

The scope of this study was intentionally smaller than the ideal size of an experimental study to make it feasible for the primary investigator to complete it within a reasonable amount of time with the resources available. Because the primary investigator is an Associate Professor at Neumann University, the participants were a sample of convenience from this student body. In addition, the initial selection was not randomized. All Neumann DPT students who did not participate in the pilot study were eligible to participate in this study.

Chapter Four

Results

This chapter contains the results and analysis of the repeated measures study examining test-taking anxiety in DPT students at Neumann University. Data was collected during a 3-week period from July 21 to August 7, 2022. Descriptive and inferential statistical analysis were utilized to answer the research questions and hypotheses and provide insight into the factors that influence test-taking anxiety within DPT students at Neumann University. The data collection instrument is provided in Appendix A. Table 2 describes the instrument variables and coding utilized during data analysis and Table 3 provides the statistical tests utilized for inferential statistics used to answer the research questions and hypotheses.

Sample

On July 21, 2022, all enrolled DPT students (n = 99) at Neumann University were notified by email about participating in the study. All students were also notified that if they had participated in the pilot study, they were ineligible for this study. Because 42 out of the 99 students had participated in the pilot, 57 students were eligible for the study. Forty-four out of 57 students participated, resulting in a 77% response rate.

Recruitment Strategies

Students who participated in the study received 1 hour of service-learning credit. Service learning is required of all NU DPT students and involves some type of volunteer activity. The primary investigator provided snacks and set up the data collection area in a convenient location near the student break area during their lunchtime to entice drop-in participation. In addition, all students who enrolled in the study were eligible to receive a $50 Visa gift card. The random drawing for the gift card occurred after data collection closed and was available to any participant who completed all parts of the study. Email reminders were sent prior to all data

collection days and follow-up reminders were sent on test-taking days to ensure participants completed the second STAI for the repeated-measures design.

Demographics

The sample was comprised of all three class cohorts of Neumann DPT students enrolled in the summer semester of 2022 who had not participated in the pilot study. Seventeen of the second-year students and 25 of the third-year students participated in the pilot study. This left 15 second-year and seven third-year students eligible. All 35 of the first-year students were eligible as this cohort was not enrolled when the pilot study took place.

The total number of participants was 44. Nine did not complete all parts of the study. The participants ranged in age from 22 to 53 with a median of 27 (M = 25, SD = 6). Most participants were first-year students (n = 25), followed by second-year (n = 14), and third-year (n = 5). More students identified as female (n = 24), than male (19). One student identified as being non-binary. Most participants identified as White (n = 31), followed by Black (n = 7), Hispanic (n = 3), and Asian (3). Two of the participants who identified as Asian, one who identified as Hispanic, and one who identified as Black also identified as White. Most participants reported being first-generation graduate students 69.8% (n = 30), and 30.2% (n = 13) reported having a parent/guardian with a graduate degree. The majority of participants had an income greater than $50,000 with the most commonly selected category greater than $75,001 (refer to Table 3 on page 67 for more details).

The participants worked a median of 25 (M = 25.12) hours per week (SD = 10) with a range of 0 to 40. Only three participants reported that their parents did not complete grade school. Collectively, 33 participants reported that both parents/guardians combined finished high school only. Slightly more participants reported that parent/guardian 1 (n = 26) and

parent/guardian 2 (n = 24) had completed an associate degree or greater (refer to Table 4 on page 68 for more details).

State-Trait Anxiety Inventory (STAI) Scores

The STAI objectively measures anxiety by asking 40 questions within two subscales related to how a person feels in different situations. The State subscale (STAI-S) measures the amount of anxiety a person is currently experiencing. The Trait subscale (STAI-T) measures the amount of anxiety a person generally experiences regardless of the situation. The range of the State subscale (Y-1) of the STAI (STAI-S) scores at baseline, during the initial data collection was 20-71, with a mean of 40.4, a median of 39, and a standard deviation of 12. The range of the Trait subscale (Y-2) of the STAI (STAI-T) score at baseline, during the initial data collection was 22-59, with a median of 42 (M = 41.6, SD = 9.8).

All but five of the participants, n = 39 (88.6%), completed the follow-up STAI-S within 30 minutes before either a written or practical exam depending on which group they were assigned based on even (practical group), or odd (written) birth month. There were 18 participants in the written group and 21 in the practical group. The range of State subscale of the STAI (STAI-S) score during the repeated measure, 30 minutes before either a written or practical exam, for both groups combined was 25-76, with a median of 52 (M = 52.3, SD = 13.3). The range of STAI S score 30 minutes prior to an exam for the written group was 25-76, with a median of 55.5 (M = 52.1, SD = 16.9). The range of STAI S score 30 minutes prior to an exam for the practical group was 35-73, and the median was 51 (M = 52.5, SD = 9.5).

A mixed-model ANOVA showed a statistically significant increase in all STAI-S scores when baseline scores were compared to those taken within 30 minutes of either type of exam ($F(1,36) = 33.59$, $p < 0.001$, $\eta p^2 = 0.483$). The mean score for all baseline STAI-S was 40.4 (SD =

12.1 with an increase in the mean of 11.9 for all follow-up STAI-S scores across both exam groups (M = 52.3, SD = 13.26).

Research Question 1

Is there a statistically significant relationship between DPT students' scores on the STAI and their gender, racial identity, age, length of enrollment in the DPT program, income level, hours worked per week, and/or educational level of parents/guardians?

Gender and STAI Scores (Questionnaire Question 1)

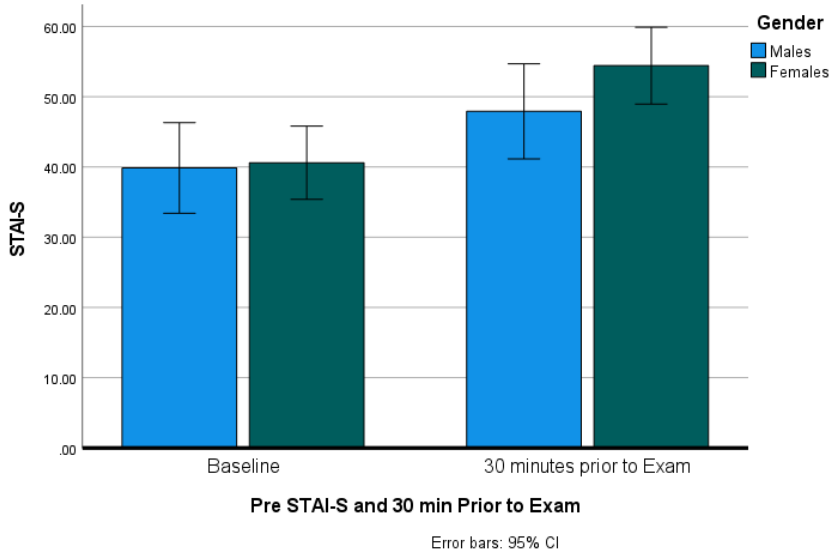
Most students identified as female (n = 24), 19 as male, and one as non-binary. Because only one participant identified as non-binary, measuring this variable could not capture significance and was therefore excluded from analysis. The mean scores for the trait subscale of the STAI (STAI-T) were slightly higher for males (M = 42.59, SD = 11.1) than females (M = 40.86, SD = 8.97), but using an Independent Samples t-Test, a significant difference was not found (p = 0.35).

At baseline, the mean STAI-S scores for males (M = 39.9, SD =12.5) and females (40.6, SD = 12.2) were similar. At follow-up, within 30 minutes before either a written or practical exam, the mean for both increased (M for males = 47.9, SD = 12.8) with a greater increase in females (M for females = 54.4, SD = 13). See Figure 1 for details. However, using a two-way mixed model ANOVA to exam STAI-S and gender, there was not a significant difference between male and female STAI -S scores both at baseline, $F(1,36) = 0.936$, $p = 0.34$, $\eta p^2 = 0.025$, and for the repeated STAI-S within 30 minutes prior taking an exam, $F(1,36) = 2.32$, $p = 0.136$, $\eta p^2 = 0.061$. Refer to Figure 1 on the next page for details.

An Independent Samples t-Test was used to examine the relationship between gender and the trait subscale of the STAI (STAI-T), which was measured once at baseline. There was not a relationship, t = 0.547(39), p = 0.587, between gender and STAI-T scores.

Figure 1

Gender and STAI-S Scores



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Because there was not a statistically significant relationship between gender and any of the STAI scores, the null hypothesis, $H1.1_O$: "There is not a statistically significant relationship between DPT students' gender identity and score on the STAI," is accepted.

Racial Identity and STAI (Questionnaire Question 2)

Because there were not enough participants in race categories other than White, the data was re-coded as "White" (n = 31) or "non-White" (n = 13). Using a two-way mixed model ANOVA with repeated measures, there was not a significant relationship between STAI-S scores and race, F (1,36) = 0.025, p = 0.875, $\eta p^2 = 0.001$, and over-time with the follow-up STAI-S 30 minutes prior to an exam, F (1,36) = 0.269, p = 0.607, $\eta p^2 = 0.007$.

An Independent Samples t-Test was used to examine the relationship between race and the trait subscale of the STAI (STAI-T), which was measured once at baseline. There was not a significant relationship, $t = 1.32(41)$, $p = 0.195$.

Because there was not a statistically significant relationship between race and any of the STAI scores, the null hypothesis, $H1.2_O$: "There is not a statistically significant relationship between DPT students' racial identity and score on the STAI," is accepted.

Age and STAI Score (Questionnaire Question 3)

Using a Pearson Correlation coefficient with 2-tailed significance and a 95% confidence interval, there was a weak, inverse relationship between baseline STAI-S scores and age ($r = -0.289$, $p = 0.079$), as well as for STAI-T ($r = -0.237$, $p = 0.136$). For the repeated-measures STAI-S across both the written and practical groups, there was also a weak inverse correlation ($r = -0.163$, $p = 0.336$). This indicates that as participants increased in age, they had lower STAI scores. Because there is a weak relationship between age and all STAI scores, the null hypothesis is rejected and the hypothesis $H1.3_A$ "There is a statistically significant inverse relationship between DPT students' age and anxiety as reflected by lower STAI scores for older students," is accepted.

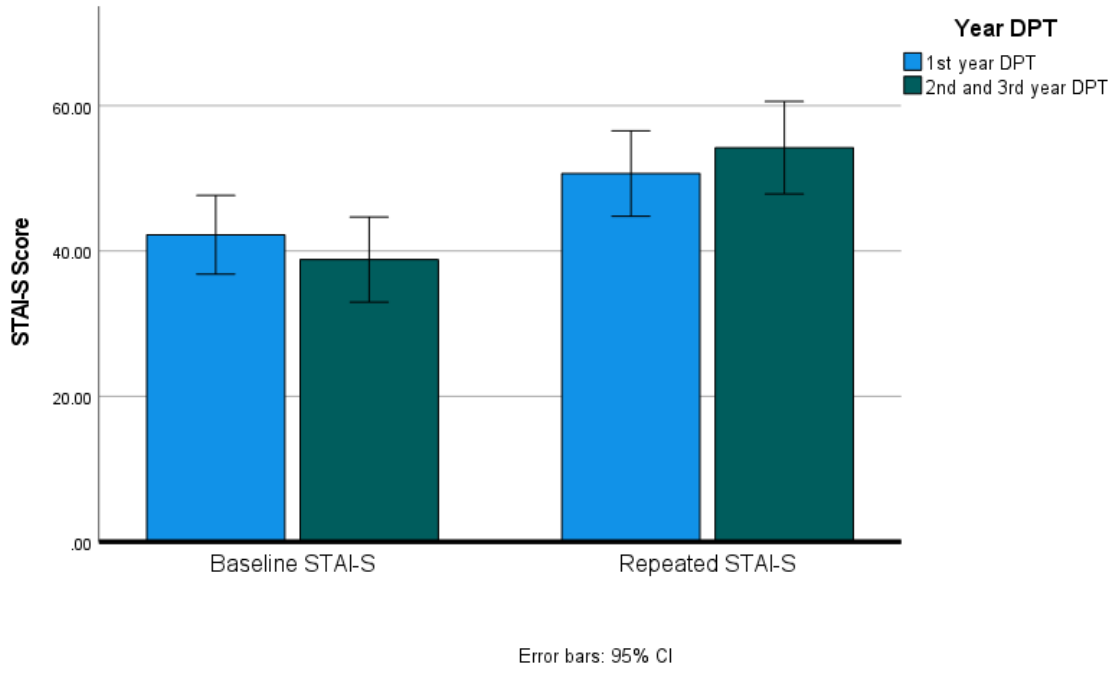
Year in DPT and STAI Score (Questionnaire Question 4)

Because there were only five third-year students the data was re-coded into two categories: first-year students ($n = 25$) or non-first year ($n = 19$). An Independent Samples t-Test was used to examine the relationship between the year in DPT and the trait subscale of the STAI (STAI-T) which was measured once at baseline. There was not a relationship between STAI-T and the year in DPT, $t = -0.184(41)$, $p = 0.855$. Using a mixed model ANOVA with repeated measures, the relationship between STAI-S scores and the year in school was close to being

significant, F (1,37) = 3.854, p = 0.057, $\eta p^2 = 0.094$. The relationship between year in school and the repeated measures STAI-S 30 minutes prior to an exam was not significant, F (1,37) = 0.00, p = 0.984, $\eta p^2 = 0.000$. Refer to Figure 2 below for details.

Figure 2

Year in School and STAI-S Scores



Because there was not a statistically significant relationship between the year in school and any of the STAI scores, although the baseline STAI-S was close with students in their first year having more anxiety, the null hypothesis, $H1.4_O$: "There is not a statistically significant relationship between DPT students' year in school and score on the STAI," is accepted.

Income and STAI Score (Questionnaire Question 7)

As shown in Table 4, on the next page, the most commonly selected income category was greater than $75,001. Because there were fewer than 10 participants in all categories for income

range except $75,000 or greater, the data was re-coded to reflect two variables, a household income of either equal to, or greater than $50,001 or less than $50,000. Refer to Table 4 below for details regarding participant income.

Table 4

Participant Household Income

Income range	Number of participants and %
Less than $15,000	5 (11.6%)
$15,000-$25,000	4 (9.3%)
$25,001- $35,000	6 (14%)
$35,001 - $50,000	3 (7%)
$50,001 - $75,000	5 (11.6)%
$75,001 or greater	20 (46.5%)

An Independent Samples t-Test was used to examine the relationship between income and the trait subscale of the STAI (STAI-T), which was measured once at baseline. There was not a relationship, $t = 0.486(40)$, $p = 0.630$. Using a two-way mixed model ANOVA with repeated measures, the relationship between STAI-S scores and income was not significant, $F(1,36) = 0.612$, $p = 0.439$, $\eta p^2 = 0.017$. The relationship between income and the repeated measures STAI-S within 30 minutes of an exam was not significant, $F(1,36) = 1.56$, $p = 0.220$, $\eta p^2 = 0.042$. Because there was not a statistically significant relationship between income and any of the STAI scores, the null hypothesis, $H1.5_O$: "There is not a statistically significant relationship between DPT students' income and score on the STAI," is accepted

Hours Worked per Week and STAI Score (Questionnaire Question 6)

Although the participants ranged from not working at all, up to 40 hours per week, the mean number of hours worked per week was 25.12 (SD = 10). Using a Pearson Correlation coefficient with 2-tailed significance and a 95% confidence interval, there was a weak, inverse relationship between baseline STAI-S scores and the number of hours worked ($r = -0.191$, $p =$

0.245), as well as for STAI-T (r = -0.216, p = 0.187). For the repeated-measures STAI-S across both the written and practical groups, there was a moderate inverse correlation (r = -0.400, p = 0.019). This indicates that the more hours a participant worked the lower their STAI score.

Because there was a statistically significant relationship between hours worked and participant STAI scores, the null hypothesis is rejected. However, the alternative hypothesis $H1.6_A$ "There is a statistically significant positive relationship between the number of hours per week a DPT student works and their STAI scores, with those working more having higher STAI scores," is also rejected because there was an inverse relationship showing that as participants worked more hours, their STAI scores decreased.

Parental Education and STAI Score (Questionnaire Question 8)

The majority of the participants' parents and guardians completed high school and some college, but the minority obtained beyond a bachelor's degree. A Master's degree was obtained by an average of 5.8% between both parents/guardians, and an average of 4.7% between both parents/guardians obtained a doctoral degree. The highest educational level achieved by all parents/guardians of the participants is reflected below in Table 5.

Table 5

Parent/Guardian Education Level

Education	Parent/Guardian 1	Parent/Guardian 2
Finished Grade School and less	n = 2 (4.7%)	n = 1 (2.3%)
Finished High School	n = 15 (34.9%)	n = 18 (41.9%)
Associates Degree	n = 5 (11.6%)	n = 6 (14%)
Bachelor's Degree	n = 14 (32.6%)	n = 16 (37.2%)
Master's Degree	n = 4 (9.3%)	n = 1 (2.3%)
Graduate/Professional degree and more	n = 3 (7%)	n = 1 (2.3%)

Because all but two categories of parent/guardian education level had less than 10 entries, the data was recoded to reflect two categories of parent/education level; either an Associate's

degree and greater or finished high school and less. An Independent Samples t-Test was used to examine the relationship between the educational level of the participants' parents and the trait subscale of the STAI (STAI-T), which was measured once at baseline. The relationship between the education level of parent 1 almost reached significance with STAI-T, $t = 1.62(40)$, $p = 0.113$, but was not significant for the educational level of parent 2, $t = 0.021(40)$, $p = 0.974$.

To examine the relationship between the educational level of both participants' parents and STAI-S scores, a three-way (2x2x2) ANOVA was utilized. The relationship between baseline STAI-S scores and the educational level of parent 1 was close to being significant, $F(1,34) = 3.88$, $p = 0.057$, $\eta p^2 = 0.102$. The relationship between baseline STAI-S and the education of parent 2 was not significant, $F(1,34) = 0.474$, $p = 0.496$, $\eta p^2 = 0.014$. The interaction between the educational level of both parents and the repeated measures STAI-S within 30 minutes of an exam was not significant, $F(1,34) = 0.320$, $p = 0.575$, $\eta p^2 = 0.009$, indicating the amount of education a participant's parents have did not influence STAI-S score.

Because there was not a statistically significant relationship between the educational level of the participant parents' and STAI scores, the null hypothesis, $H1.7_O$: "There is not a statistically significant relationship between the educational level of a DPT students' parents and their STAI score," is accepted.

Research Question 2

Is there a statistically significant difference between the amount of anxiety, as measured by the STAI-S score, for DPT students taking a written or a practical examination within the next 30 minutes? (STAI scores and written [W] or practical group [P])

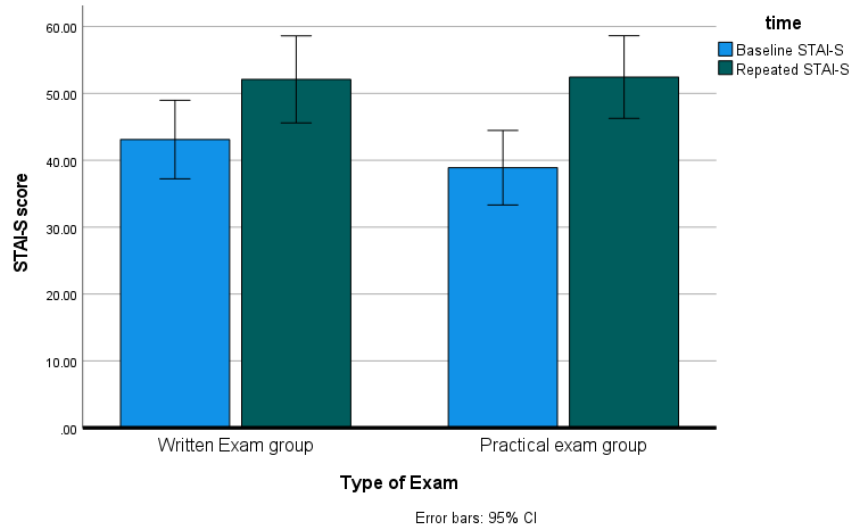
Students were grouped into either the written or practical exam group based on their birth month. Students with an even group month were grouped into the practical exam group (n = 23).

Students with an odd birth month were grouped into the written exam group (n = 20). Five students did not take the repeated measures STAI-S within 30 minutes of an exam.

The mean baseline STAI-S score for participants in the practical exam group was 38.9 (SE = 2.74). For participants in the written exam group, baseline STAI-S mean was 43.11 (SE = 2.89). STAI-S scores taken within 30 minutes of an exam increased to a mean of 52.45 (SE = 3.05) for the practical exam group and 52.11 (SE = 3.2) for the written exam group. Using a mixed-model ANOVA with repeated measures, there was not a significant relationship between the STAI-S follow-up scores within 30 minutes of an exam and the type of exam (either written or practical), $F(1,36) = 1.5$, $p = 0.228$, $\eta p^2 = 0.040$. Refer to Figure 3 below for details. Because there was not a statistically significant relationship between the type of exam taken and the repeated measures STAI-S scores, the null hypothesis, $H2_O$: "There will be no significance difference in STAI-S score 30 minutes prior to DPT students taking a practical exam when compared to a written exam," is accepted.

Figure 3

Repeated STAI-S Scores and Exam Type



Research Question 3

Do DPT students with more life roles experience greater anxiety, resulting in statistically significant higher STAI scores, than those with less life roles? (Questionnaire Question 11)

The number of life roles reported for participants ranged from 1 to 4 with a mean of 1.9 (M = 2, SD = 0.92). The list of life roles provided to participants on the data collection questionnaire included "spouse or partner," "caretaker for children," "caretaker for parents," "employed," "volunteer," "member of a church or other organization," and "other." Four participants (9%) responded "other." Using a Pearson Correlation coefficient with 2-tailed significance and a 95% confidence interval, there was a not a relationship between baseline STAI-S scores and the number of life roles ($r = -0.031$, $p = 0.848$). There was a weak inverse relationship that did not reach significance between the number of life roles and STAI-T baseline score ($r = -0.147$, $p = 0.365$) and repeated-measures STAI-S across both the written and practical groups ($r = -0.233$, $p = 0.171$). This indicates that the more life roles a participant had the lower their STAI score.

Because the mean number of life roles was low ($n = 1.9$), and because none of the test results reached significance, the findings for the relationship between life roles and STAI are inconclusive. The null hypothesis, $H3_O$: "DPT students with more life roles will not have statistically significant higher STAI scores when compared to those with less life roles" is accepted.

Research Question 4

Do DPT students who report currently being anxious score higher on the STAI? (Questionnaire Questions 13)

When asked to quantify the amount of anxiety typically experienced "on a daily basis"

using a 5-point Likert scale, with "1" indicating "not at all," "2" indicating "slightly worried," "3" indicating "somewhat worried," "4" indicating "moderately worried," and "5" indicating "extremely worried," the majority (n = 16, 37.2%) indicated they were "slightly worried." In addition to daily worry, the data collection questionnaire also asked participants which type of exam caused the most worry. The results for all questions appear below in Table 6. This table also shows the amount of worry, measured on the same 5-point Likert scale participants reported experiencing when taking a written test (Questionnaire Question 14), a practical exam (Questionnaire Question 15), a practical exam (Questionnaire Question 15), and a comprehensive exam (Questionnaire Question 16).

Table 6

Amount of Worry

Amount of worry	Daily worry	Written test	Practical	Comp Exam
Not at all (1)	n = 7 (16.3%)	n = 1 (2.3%)	n =0	n =0
Slightly (2)	n = 16 (37.2%)	n = 6 (14%)	n = 5 (11.6%)	n = 3 (7.1%)
Somewhat (3)	n = 9 (20.9%)	n = 8 (18.6%)	n = 9 (20.9%)	n = 5 (11.9%)
Moderately (4)	n = 10 (23.3%)	n = 15 (34.9%)	n = 19 (44.2%)	n = 11 (26.2%)
Extremely (5)	n = 1 (2.3%)	n = 13 (30.2%)	n = 10 (23.3%)	n = 23 (54.8%)

Using a Spearman rho correlation test with a 95% confidence interval and two-tailed significance, there was a weak relationship between the baseline STAI-S score and the amount of daily worry reported ($r = 0.216$, $p = 0.165$), and a moderate relationship between the repeated measures STAI-S score within 30 minutes of an exam ($r = 0.464$, $p = 0.003$) and the baseline trait STAI subscale (STAI-T) ($r = 0.478$, $p = .001$). This indicates that participants who reported more daily worry also had more anxiety reported on the STAI as reflected by higher scores. The null hypothesis is rejected, and the hypothesis $H4_A$ "DPT students who currently report higher levels of anxiety on the data collection questionnaire will score statistically significantly higher, than those who do not, on the STAI.," is accepted.

Research Question 5

Do DPT students with a history of anxiety themselves or a parent/guardian with a history of anxiety have greater anxiety, as measured by the STAI? (Questionnaire Questions 9, 12)

When asked whether participants experienced increased anxiety at any point in their life prior to becoming a DPT student at NU, most participants (n = 34, 79.1%) reported "yes." Nine respondents (20.9%) responded "no," and one participant did not respond. Using an Independent Samples t-Test, there was not a relationship between the baseline STAI-S and having a history of anxiety ($p = 0.822$), and the baseline STAI-T ($p = 0.438$). However, there was a significant relationship between the repeated measures STAI-S within 30 minutes of an exam and a participant reporting a history of anxiety ($p = 0.016$) with those reporting a history of anxiety having a greater increase in STAI-S score. The null hypothesis, $H5.1_O$: "DPT students who report a history of anxiety will not score higher on the STAI than those who do not," was rejected and the hypothesis was accepted for the test-taking component measured by the repeated measures STAI-S.

When asked whether one or more of their parents/guardians regularly experiences anxiety, 58.1% (n = 25) of the participants replied "yes," 27.9% (n = 12) replied "no," and 14% (n = 6) were unsure. One participant did not respond. Using an Independent Samples t-Test, there was not a relationship between the baseline STAI-S score and having a parent with a history of anxiety ($p = 0.632$), the baseline STAI-T score ($p = 0.938$), or the repeated measures STAI-S within 30 minutes of an exam ($p = 0.877$). The null hypothesis, $H5.2_O$: "DPT students with a parent/guardian with a history of anxiety will not score statistically significantly higher on the STAI than those who do not report a patient/guardian with a history of anxiety," is accepted.

Research Question 6

Do DPT students who report anxiety management strategies score lower on the STAI? If so, which strategies appear most effective? (Questionnaire Questions 20, 21, 23)

When asked whether participants have a specific strategy to manage anxiety, most participants (n = 31, 72.1%) reported "yes." Twelve respondents (27.9%) responded "no," and one participant did not answer the question. Using an Independent Samples t-Test, there was not a relationship between the baseline STAI-S and whether a participant reported having an anxiety management strategy ($p = 0.311$). This was also true for the baseline STAI-T ($p = 0.577$) and the repeated measures STAI-S within 30 minutes of an exam ($p = 0.153$). Because participants who reported having an anxiety management strategy did not have any significant differences in any of the STAI scores, the null hypothesis, $H6_O$: "DPT students with anxiety reduction strategies will not have statistically significant lower STAI scores than those who do not have strategies," is accepted. Refer to Table 7, below, for a summary of all research hypothesis, statistical tests used for inferential statistics, and whether the hypotheses were accepted or rejected. The number of participants for each question ranged from 39-44 because five participants did not complete the repeated measures STAI-S. Therefore, for questions containing a component involving the repeated measures STAI-S score, the n was 39.

Table 7

Research Hypotheses Findings (n = 39 - 44)

Alternate Hypothesis	**Statistical test**	**Findings**	**Null Hypothesis Rejected**
H1.1: Female gender increases STAI score	Independent Samples t-Test for STAI-T; 2-way mixed model ANOVA for STAI-S	No relationship between STAI-T ($p = 0.587$) and baseline STAI-S ($p = 0.34$) and gender. Repeated measures STAI-S scores increased more in females ($M = 54.4$, $SD = 13$) than males ($M = 47.9$, $SD = 12.8$) but relationship	No

		between repeated STAI-S and gender was not significant ($p = 0.136$).	
H1.2: Minority participants will have higher STAI score	Independent Samples t-Test for STAI-T; 2-way mixed model ANOVA for STAI-S	No relationship between race and STAI-T ($p = 0.195$). No relationship found between STAI scores and race for baseline STAI-S ($p = 0.875$) and repeated measures STAI-S ($p = 0.607$).	No
H1.3: Age is inversely related to STAI score	Pearson Correlation coefficient	Weak inverse relationship between baseline STAI-S and age ($r = -0.289$), STAI-T and age ($r = -0.289$) and repeated measures STAI-S and age ($r = -0.163$).	Yes
H1.4: Year in DPT inversely related to STAI score	Independent Samples t-Test for STAI-T; 2-way mixed model ANOVA for STAI-S	No relationship between STAI-T and year in DPT ($p = 0.855$). Relationship between baseline STAI-S scores and DPT year close to significant ($p = 0.057$). No relationship between repeated measures STAI-S and year in DPT ($p = 0.984$)	No
H1.5: Income is inversely related to STAI score	Independent Samples t-Test for STAI-T; 2-way mixed model ANOVA for STAI-S	No relationship between STAI-T ($p = 0.630$), baseline STAI-S scores (0.612) and repeated measures STAI-S ($p = 0.042$) and income.	No
H1.6: Working more hours increases STAI score	Pearson Correlation coefficient	Weak, inverse relationship between STAI-T ($r = -0.216$) and baseline STAI-S scores ($r = -0.191$) and the number of hours worked, with those working more hours reporting less anxiety. Moderate inverse relationship between repeated-measures STAI-S for both the written and practical groups ($r = -0.400$).	Yes *Alternate Hypothesis also rejected
H1.7: Parent education inversely related to STAI score	Independent Samples t-Test for STAI-T; 3-way mixed model ANOVA for STAI-S	Relationship between the education level of parent 1 almost significant with STAI-T ($p = 0.113$) and baseline STAI-S ($p = 0.057$). Not significant for parent 2 STAI-T ($p = 0.974$) and baseline STAI-S ($p = 0.496$). Interaction between the educational level of both parents and repeated STAI-S not significant ($p = 0.575$).	No
H2: Practical exams increase STAI-S score more	Mixed model ANOVA with repeated measures	No significant relationship between the STAI-S follow-up scores within 30 minutes of an exam and type of exam (either written or practical ($p = 0.228$, $\eta p^2 = 0.040$).	No

H3: More life roles increase STAI score	Pearson Correlation coefficient	No relationship between baseline STAI-S and life roles (r = -0.031). Weak inverse relationship (approaching significance) between life roles and STAI-T (r = -0.147) and for repeated STAI-S across both written and practical groups, (r = -0.233).	No
H4: High reported anxiety increases STAI score	Spearman rho correlation test	Weak relationship between baseline STAI-S and daily worry (r = 0.216). Moderate relationship between STAI-T (r = 0.478) and repeated STAI-S (r = 0.464) and anxiety as measure by "daily worry."	Yes
H5.1: History of anxiety increases STAI score	Independent Samples t-Test	No relationship between STAI-T (p = 0.438) and baseline STAI-S (p = 0.822) and participants with anxiety history. However, significant relationship between repeated STAI-S participants with history of anxiety (p = 0.016).	No Yes, for test-taking anxiety.
H5.2: Parent or guardian with anxiety increases STAI score	Independent Samples t-Test	Relationship between STAI-T (p = 0.632), baseline STAI-S (0.938) and parent/guardian history of anxiety was not significant. The relationship between repeated STAI-S and patient anxiety was significant (p = 0.877).	No
H6: Management strategies decreases STAI score	Independent Samples t-Test	Relationship between STAI-T (p = 0.577), baseline STAI-S (0.3111) and repeated STAI-S (p = 0.153) and having a management strategy was not significant	No

Anxiety Management Strategies

Participants were asked to select all the anxiety management strategies they typically utilized, with an opportunity to enter "other" responses. The most common response was "exercise" (n = 36, 83.7%), followed by "talking with a friend or loved one" (n = 30, 69.8%) and "relaxing" (n = 27, 62.8%). The eight strategies that were listed on the data collection form and the number of participants who selected them as well as the relationship, as measured using an Independent Samples t-Test, with the repeated measures STAI-S score taken within 30 minutes of an exam are provided in Table 8.

Table 8

Anxiety Management Strategies and Repeated STAI-S Score

Strategy listed on data questionnaire	Participants	t (DF)	Cohen's d	p
Exercise	n = 36 (83.7%)	-1.48 (36)	-0.619	01.48
Taking with a friend or loved one	n = 30 (69.8%)	1.89 (36)	0.675	0.067
Relaxing	n = 27 (62.8%)	1.03 (36)	0.370	0.308
Hobby	n = 19 (42.2%)	1.94 (36)	0.629	0.260
Alcohol	n = 11 (25.6%)	0.291 (36)	0.11	0.773
Meditation	n = 12 (27.9%)	1.02 (36)	0.370	0.308
Medication	n = 8 (18.6%)	1.65 (36)	0.691	0.107
Psychotherapy	n = 1 (2.3%)	-0.375 (36)	-0.380	0.710
Other	n = 16 (37.2%)	-0.711 (36)	-0.236	0.482

Other Anxiety Management Strategies (Questionnaire Questions 18, 20, 22)

Participants had three different opportunities on the data collection questionnaire to enter strategies for anxiety management. The first was the open-ended question (number 18), which stated: "please list the strategies you use to help manage your anxiety." The second was entering a strategy in the open space after selecting the "other" category for question number 20, described above, and the third was in the open-ended question number 22, which stated: "Please enter any additional comments related to how you manage your anxiety." When a participant wrote a strategy in response to question 18 that was captured in the responses listed for question 20, it was recorded there during data analysis. In addition, when a respondent provided a response other than what was listed in question number 20, either as an "other" response within that question or in the open-ended questions 18 or 22, it was captured just one time to avoid double reporting. The anxiety management strategy most reported outside of the eight strategies listed on the data collection questionnaire was "breathing" followed by having a "positive outlook." The other open-ended responses to additional anxiety management strategies are reflected in Table 9.

Table 9 ***Additional Anxiety Management Strategies***	**Participants**
Breathing	n = 10 (22.7%)
Having a positive outlook	n = 5 (11.4%)
Practicing mindfulness and/or gratitude	n = 3 (6.8%)
Listening to music	n = 3 (6.8%)
Self-talk strategies	n = 3 (6.8%)
Worker harder/increase focus	n = 2 (4.5%)
Balance leisure with study	n = 2 (4.5%)
Interact with a pet	n = 2 (4.5%)
Clean/de-clutter	n = 1 (2.3%)
Isolation prior to the test	n = 1 (2.3%)
Reading	n = 1 (2.3%)
Trying a challenge	n = 1 (2.3%)
Eating	n = 1 (2.3%)
Pacing	n = 1 (2.3%)
Hot shower	n = 1 (2.3%)
Video games	n = 1 (2.3%)
Reflection	n = 1 (2.3%)
Watch motivational video	n = 1 (2.3%)
Full body isometric contraction	n = 1 (2.3%)
Sleep	n = 1 (2.3%)
Schedule time	n = 1 (2.3%)
Close eyes	n = 1 (2.3%)
Video games	n = 1 (2.3%)

Sources of Anxiety (Questionnaire Question 14)

In response to the open-ended question number 14 “what makes you most nervous?” the theme that captured the most common responses was “Failure” (n = 12, 27.3%), followed by “not knowing the material” (n = 9, 20.5%), and the “consequences of poor performance” (n = 7, 16%). For a complete list of the responses to this question please refer to Table 10 below.

Table 10 ***What Makes Participants Most Nervous***	**Participants**
Failure	n = 12 (27.3%)
Not knowing the material	n = 9 (20.5%)
Consequences of poor performance	n = 7 (16%)
Practical exams	n = 5 (11.4%)

Volume of work	n = 4 (9%)
Comprehensive exams	n = 3 (6.8%)
Times tests	n = 3 (6.8%)
Being late	n = 2 (4.5%)
Letting family down	n = 2 (4.5%)
High expectations	n = 2 (4.5%)
Perception of professor/others	n = 2 (4.5%)
Final exams	n = 2 (4.5%)
Waiting for the grades	n = 1 (2.3%)
Presentations	n = 1 (2.3%)
Desire to perform well	n = 1 (2.3%)
Disappointment	n = 1 (2.3%)
Money/Expenses	n = 1 (2.3%)
Lack of time	n = 1 (2.3%)
Not knowing what to expect	n = 1 (2.3%)

Physical Symptoms of Anxiety (Questionnaire Question 18)

In response to the open-ended question 15: "List any physical symptoms that occur to you when taking a test," most participants reported an increase in heart rate (n = 26, 59%), followed by "sweating" (n = 15, 34%), and then "shaking" (n = 6, 13.6%). Participants were allowed to list more than one symptom, as reflected in the response rates. For a complete list of the responses to this question, refer to Table 11 below.

Table 11 ***Physical Symptoms of Anxiety During Test-taking***	**Participants**
Increased heart rate	n = 26 (59%)
Sweating	n = 15 (34%)
Shaking	n = 6 (13.6%)
Shortness of breath and/or rapid breathing	n = 5 (11.4%)
Dry mouth	N = 4 (9%)
Heavy/tightness in chest	n = 2 (4.5%)
Restless	n = 2 (4.5%)
Dehydrated	n = 1 (2.3%)
Hunger	n = 1 (2.3%)
Crying	n = 1 (2.3%)
Pins and needles in body	n = 1 (2.3%)
Clenched teeth	n = 1 (2.3%)
Decreased concentration	n = 1 (2.3%)

Upset stomach	n = 1 (2.3%)
Nausea	n = 1 (2.3%)
Increased blood pressure	n = 1 (2.3%)

Perceived Causes of Anxiety (Questionnaire Question 16, 22)

When asked whether they "experienced test-taking anxiety perceived to interfere with academic performance," most participants reported "no" (n = 24, 55.8%), followed by "yes" (n = 19, 44.2%). One participant did not answer the question. In response to the open-ended question (16) "What sources of anxiety do you perceive to most impact test-taking as a DPT student at Neumann University?" the theme reported by most participants was "consequences of failure" (n = 14, 31.8%), followed equally by "type of exam" (n = 3, 6.8%) and "expectations" (n = 3, 6.8%). Thirty-eight out of 44 participants answered this question (86.4%). For a complete list of the responses to this question, refer to Table 12 below.

Table 12

Anxiety Sources That Impact Test-Taking	**Participants**
Consequences of failure	n = 14 (31.8%)
Type of exam	n = 3 (6.8%)
Expectations	n = 3 (6.8%)
Other students having anxiety	n = 2 (4.5%)
Lack of time to study	n = 2 (4.5%)
Amount of material on a test	n = 2 (4.5%)
Course/professor associated with exam	n = 2 (4.5%)
Over-thinking	n = 1 (2.3%)
Not having a strategy	n = 1 (2.3%)
Being late	n = 1 (2.3%)
Lack of sleep	n = 1 (2.3%)
Level of subject knowledge	n = 1 (2.3%)
Lack of preparation	n = 1 (2.3%)
Test-taking	n = 1 (2.3%)
Conflict in personal life	n = 1 (2.3%)
Not eating breakfast	n = 1 (2.3%)
Self-doubt	n = 1 (2.3%)

External Support (Questionnaire Question 24)

Participants were asked to quantify the amount of external support (emotional, physical, and financial) they received from friends and family members on a regular basis using a 5-point Likert scale with "1" indicating "no support," "2" indicating "slight support," "3" indicating "some support," "4" indicating "moderate support," and "5" indicating "extreme support," the majority (n = 18, 41.9%) indicated they received "moderate support," followed closely by "extreme support" (n = 15, 34.9%), "some support" (n = 8, 18.6%), and then equally by "no support" and "slight support" with both having an n = 1 (2.3%).

Grade Point Average (Questionnaire Question 5)

The participants' grade points averages (GPAs) ranged from a minimum of 0.889 to a maximum of 4.0 (M = 3.51, SD = .62). Using a two-tailed Pearson correlation coefficient, there was a moderate inverse correlation between GPA and the baseline STAI-S (r = -0.414, p = .006), a weak inverse correlation between the repeated STAI-S measured within 30 minutes of either a written or practical exam (r = -0.219, p = 0.186), and a weak inverse correlation between GPA and the baseline STAI-T (r = -0.307, p = .048). These relationships show that as GPA increased the amount of anxiety, as measured by the STAI decreased.

The results of this study revealed a statistical relationship between the baseline and repeated measures STAI-S scores taken 30 minutes prior to an examination where the increase in score was statistically significant. Participants reporting more worry and those with a history of anxiety also scored statistically significantly higher on the STAI. In addition, there were inverse relationships between age and the number of hours worked per week and STAI scores, with STAI decreasing as age and hours worked increased. The type of exam (written vs. practical) did not statistically significantly show a relationship with the participants' STAI score. Nor did the

participants' gender, identity, race, year in school, household income, educational level of parents/guardians, number of participant life roles, parental history of anxiety, and having anxiety reduction strategies. These results and their implications for future practice and research will be discussed next in Chapter 5.

Chapter 5

Discussion

The purpose of this research study was to examine the influence of personal and environmental factors on anxiety in Doctor of Physical Therapy (DPT) students. Demographic data and information about grade point average, hours worked per week, parental education, personal or family history of anxiety, number of life roles, amount of worry in specific test-taking situations, amount of external support, as well as the presence and type of anxiety reduction strategies were used to determine whether these factors had a relationship with the amount anxiety experienced by DPT students at Neumann University. The State-Trait Anxiety Inventory (STAI), which contains two subscales, state (STAI-S), and trait (STAI-T), was used to measure participant perception of anxiety both at baseline, on a non-test day, and the state subscale (STAI-S) was used a second time, in a repeated measures design, to capture the amount of anxiety participants experienced the 30 minutes before taking either a written or practical exam. Identifying the causes of anxiety experienced by DPT students is an important first step in developing anxiety reduction strategies to limit its negative impact and improve the quality of life for DPT students.

The study findings indicate that STAI-S scores significantly increased prior to taking either a written or practical exam, but the type of exam did not statistically influence the score. Participants with a history of anxiety had higher STAI scores, indicating they were experiencing more anxiety. Older participants and those who worked more hours scored significantly lower on the STAI than younger participants who worked less hours showing an inverse relationship between amount of anxiety and age as well as hours worked. In addition, there was an inverse relationship between GPA and STAI showing students with higher GPAs had statistically significantly less anxiety, especially for the baseline STAI-S scores. The gender of the

participants, income, year in school, grade point average, parental education and history of anxiety, number of life roles, and use of anxiety reduction strategies did not significantly impact STAI scores.

Baseline State Anxiety

Because this study considers the factors that influence anxiety through the lens of the stress diathesis model, the "stress" component, which is described as the situational circumstances and external influences, is objectively measured by the state subscale of the State-Trait Anxiety Inventory (STAI-S). The STAI-S measures the amount of anxiety a person is currently experiencing and is thought to reflect environmental stressors which may trigger physiologic arousal (Wiedemann, 2015).

The mean STAI-S score at baseline for all participants in this study was 40.4 (SD = 12) with a range of scores from 20 to 71. These scores are consistent with those found in the pilot study (M = 39) and are above the cut score of 39-40 reported by Knight et al. (1983) and Addolorato et al. (1994) to detect clinically significant symptoms of anxiety for the STAI-S subscale. Participant scores in this study are also higher than those described in the STAI manual published by Spielberger (1983), which reports a mean normative score of 38.76 (SD = 11.94) for female college students and 36.47 (SD = 10.02) for males. For working adults, the same manual lists a mean of 35.2 (SD = 10.6) for working adult females and 35.7 (SD = 10.4) for working adult males.

Other studies measuring anxiety using the STAI-S at baseline for DPT students were not identified. However, the findings of this study are consistent with findings using other anxiety-measurement tools. A large survey study (n = 1,238) by Bogardus et al. (2021) found increased levels of anxiety in DPT students in the United States as measured by the anxiety subscale within

the Depression, Anxiety and Stress Scale (DASS). Thomas-Davis et al. (2020) also used the DASS to examine stress and anxiety in 29 first-year occupational and physical therapy students and found that 50% of the females in the study and 44% of the males scored in either the mild or severe ranges of stress and anxiety as measured by the DASS-21. Other current literature (Bogardus et al., 2021, Ferreira et al., 2020; Kafeel et al., 2018; Macauley & Plummer, 2017) also suggests that DPT students experience greater anxiety than age-matched norms.

Trait Anxiety

The trait subscale of the STAI (STAI-T) captures the "diathesis" component of the stress diathesis model by objectively measuring how a person "generally feels," which is meant to capture a person's predisposition to anxiety by considering their underlying personality attributes. The mean STAI-T score at baseline for participants in this study was 41.6 (SD = 9.8) with a range of 22-59. These scores are lower than the pilot study, in which the average STAI-T was 43. Existing studies reporting STAI-T scores for DPT students were not found in the literature. However, the STAI manual (Spielberger, 1983) reports an STAI-T mean score of 40.4 (SD = 10.2) for female college students and 38.3 (SD = 9.2) for male college students, and an overall mean of 36 (SD = 9) for working adults. Although cut-off scores are not published by the creator of the STAI-T, a study by Zingano et al. (2019) established a cutoff score of >53 on the STAI-T to have approximately 80% (44.4 – 97.7) sensitivity and 60% (46.5 – 68.6) specificity for detecting anxiety disorders in persons with epilepsy.

Therefore, the participants in this study appear to have trait anxiety levels slightly less than the participants in the pilot study, but higher when compared to a normative population. However, based on a cut score reported by Zingano et al. (2019), the STAI-T scores reported by

participants in this study do not appear high enough to be considered indicative of a mental health disorder.

Repeated Measure of Test-Taking Anxiety

To examine the influence of "stress" as described by the stress diathesis model to involve external environmental conditions, the participants in this study re-took the STAI-S in a repeated measures design, within a 30-minute window prior to either a written exam or practical exam. The mean STAI-S score 30 minutes prior to an exam for the written group was 52.1 (SD = 16.9), 52.5 (SD = 9.5) for the practical exam group, and 52.3 (SD = 13.3) for both groups combined. This increase in STAI-S score for both groups was like that in the pilot (53) and statistically significant ($p < 0.001$), showing that the condition of taking a test increased anxiety as reflected by an increase in the STAI-S score. The increase in STAI-S scores just prior to test taking is consistent with those found by Macauley and Plummer (2017), who reported that 36% of the students surveyed scored in the moderately high, high, or extremely high-test anxiety category as measured by the Westside Test Anxiety Scale (WTAS).

Contrary to the hypothesis that taking a practical exam would increase anxiety more than taking a written exam, there was not a statistically significant difference between the increase in STAI-S scores for the written exam group when compared to the practical exam group. This finding is consistent with a study by Zhang and Henderson (2014), who used the Spielberger Test Anxiety Inventory (TAI) to examine the relationship between test anxiety, and academic performance during both OSCEs and written exams in 166 chiropractic students. In this study, total test anxiety, measured by TAI scores, had a small negative correlation ($R^2 = 6.7\%$, $p = 0.001$) for written exams and was not statistically a significant predictor of physical exam performance as measured during a practical exam.

On the other hand, a study by Brand and Schoonheim (2009) found higher levels of anxiety, as measured by the STAI-S, reported by dental students in the practical testing group compared to those taking a written test, which contrasts the findings in this study. Additional studies are needed to determine the impact of the type of test on test-taking anxiety in DPT students.

Gender and Anxiety

Contrary to the hypothesis that females would report greater anxiety than males, as reflected by higher STAI scores, gender did not statistically significantly influence STAI scores in this study. This finding contrasts with the pilot study in which female participants had higher STAI-S and STAI-T scores at baseline as well as a statistically significant increase, when compared to males, on the repeated measures STAI-S within 30 minutes of either type of exam.

Unlike the findings in this study, Zhang and Walton (2018) found statistically significantly higher Test Anxiety Inventory scores and emotionality scores in females when compared to males. Likewise, Thomas-Davis et al. (2020) reported higher stress scores reported on the Depression Anxiety and Stress Scale (DASS) for female occupational and physical therapy students when compared to their male counterparts. In addition, Macauley and Plummer (2017) found that scores on the Westside Test Anxiety had a statistically significant relationship with the female gender ($p < 0.019$). Considering the relatively low number of participants in this study, and the variable findings in the existing literature, additional studies are needed to determine whether gender significantly influences anxiety levels in DPT students.

Age and Anxiety

Like the findings in the pilot study, there was a weak, inverse correlation between baseline STAI-S scores and age for both the baseline STAI-S ($r = -0.289$), the STAI-T ($r = -$

0.237), and the repeated-measures STAI-S across both the written and practical groups (r = -0.163), showing that as participants increased in age, they had lower STAI scores. These finding contrast the findings reported by Williams et al. (2018), which showed that DPT students 29 and older had statistically significantly higher scores for DASS-21 Depression (p = .05), DASS-21 Anxiety (p = .027), and DASS-21 Stress (p = .007) than students under 25 years old. Williams et al. (2018) hypothesized that for older DPT students, the pressure of balancing being a student with other life roles and financial responsibilities may have a cumulative effect on anxiety and stress. On the contrary, like this study, Macauley and Plummer (2017) did not find a relationship between age and anxiety in a study of 135 first and second-year DPT students.

Life Roles and Anxiety

Because many NU DPT students are older than traditional students, the impact of the number of life roles on anxiety, as measured by STAI scores, was investigated. Like the findings in the pilot study, the relationship between the number of life roles and STAI scores did not reach statistical significance. However, there was a weak inverse trend between the number of life roles and STAI-T baseline score (r = -0.147) and repeated-measures STAI-S across both the written and practical groups (r = -0.233), showing that the participants with more life roles had slightly less anxiety than those with fewer life roles. However, the strength of this finding is limited by the low mean number of life roles (n = 1.9). Future studies with better-defined life roles categories and a greater number of subjects are needed to better understand the relationship between life roles and anxiety in DPT students.

Racial Identity and Anxiety

Most participants in this study identified as White (n = 31), followed by Black (n = 7), Hispanic (n = 3), and Asian (3). Four of the participants identified as being multiracial. Because

there were not enough participants in the race categories other than White, the data was re-coded into the dichotomous categories of “White” or “non-White” for the inferential statistical studies to improve the strength of the tests. Significant relationships were not found between race and STAI scores, both at baseline for the STAI-S and STAI-T as well as for the follow-up STAI-S 30 minutes prior to an exam.

Because the number of non-White participants in this study was low (n = 13), the implications of the findings are limited. Although large studies examining the relationship between race and anxiety in DPT students were not identified, a preliminary study by Fabrizio et al. (2021) found a statistically significant relationship between race and academic performance ([$t(31) = 2.93$, $p < 0.01$], with participants who identified as white having higher course grades than those who identified as non-White. However, like in this study, the number of non-White students was low (10/33). Additional, larger studies with a more diverse population are needed to determine the impact of race on anxiety in DPT students.

Income and Anxiety

The majority of participants in this study reported a household income greater than $50,000 (n = 25) with the most commonly selected category greater than $75,001 (n = 20). According to the U.S. Census Bureau (2021), the median household income in 2020 was $67,521. Nine study participants reported a household income of less than $25,000, which is considered living in poverty for a family of four or more (Shrider et al., 2021). There were not statistically significant relationships found between income and any of the STAI scores in this study.

Studies looking at the influence of income and anxiety in DPT students alone were not identified. However, unlike the results of this study, a survey study (n = 2,843) by Eisenberg et

al. (2007) of both graduate and undergraduate students found a statistical relationship between students reporting financial strain and mental health problems (odds ratios – 1.6 - 9.0). Likewise, a larger study of 27,409 college students found that those with poor mental health/depression were more likely to report having lower socioeconomic status than those without (Weitzman, 2004). Because most participants in this study reported a similar household income, which exceeded the median household income in the United States, the ability of this study to measure the impact of income on anxiety is limited and additional studies are warranted.

Year in DPT and Anxiety

This study did not find a statistically significant relationship between the year in DPT and anxiety, as measured by STAI score. However, there were more first-year students (25) than any other group in this study, therefore the findings may not be conclusive. The lack of a relationship between the year in school and STAI score found in this study contrasts with a study completed by Rizzolo and Massey (2020), who reported that anxiety decreased in allied health graduate students the longer a student spent in school. Similarly, Bogardus et al. (2021) examined anxiety levels and year in school and found that anxiety in first-year DPT students was statistically higher ($p = 0.001$) than in the third-year students.

In contrast, Ellison et al. (2020) who surveyed 59 DPT students enrolled at the Texas Woman's University-Houston, School of Physical Therapy using the 21-item Depression, Anxiety, and Stress Scale (DASS-21) did not find a correlation between the year in school and anxiety level. Similarly, a study by Williams et al. (2018) found that second-year students had higher scores for DASS-21 Depression ($p = .003$), DASS-21 Anxiety ($p = .027$), and DASS-21 Stress ($p = .016$), than students in their first didactic semester.

Hours Worked per Week and Anxiety

Participants in this study reported working a rage of hours from not at all, up to 40 hours per week. There was a weak, inverse relationship between baseline STAI-S scores and the number of hours worked ($r = -0.191$), as well as for STAI-T ($r = -0.216$) and a moderate inverse correlation ($r = -0.400$) for the repeated measures STAI-S taken within 30 minutes of an exam.

Studies examining the number of hours worked per week and the relationship between anxiety in DPT students could not be identified for comparison. It is important to note that the average number of hours participants worked in this study was 25, which may limit the applicability of the relationship between working and anxiety in this population. In addition, although it was not directly measured, prior conversations with DPT students at NU suggests that many students work in the field of PT and enjoy being able to apply what they are learning in school at work. Perhaps the comradery of being around others in the field, being able to apply course material, and the time away from studying, offers a protective mechanism from anxiety. Additional studies are needed to better understand the relationship between outside work and anxiety levels in DPT students.

Self-Reported Anxiety and STAI Score

A presence of both current and past anxiety was collected in this study. The question "Have you experienced increased levels of anxiety at any point in your life prior to becoming a DPT student at NU?" was included in the data collection questionnaire, with the dichotomous choice of "yes" or "no," to examine whether DPT students with anxiety prior to being enrolled in a DPT program would report higher levels of anxiety than those without. As determined by an Independent Samples t-Test, there was not a statistical relationship between the baseline STAI-S and having a history of anxiety.

On the other hand, participants who reported a history of anxiety score statistically significantly higher on the repeated measures STAI-S ($p = 0.016$) recorded 30 minutes prior to taking either a practical or written exam. This finding suggests that those with a history of anxiety experience more anxiety when taking a test, regardless of the type. However, the applicability of this finding to a larger sample is likely limited since only 21% of participants ($n = 9$) in this study did not report a history of anxiety. The increased number of DPT students reporting a history of anxiety is consistent with the increase reported across all college counseling centers, which, according to Gallagher (2014), reported an 89% increase in students presenting with an anxiety disorder from 2009 until 2014.

To capture the amount of anxiety participants were experiencing at the time of the initial data collection, they were asked to quantify, using a 5-point Likert Scale, with "1" indicating "not at all," and "5" indicating "extremely worried," the amount of worry they typically experience on a "daily basis." The majority (37.2%) indicated they were "slightly" worried, followed by "moderately" (23.3%) worried. There was a weak relationship between baseline STAI-S scores and the amount of self-reported worry ($r = 0.216$) and a moderate relationship with both baseline STAI-T ($r = 0.478$) and repeated measures STAI-S ($r = 0.478$).

These findings are consistent with many studies indicating that DPT students report higher anxiety levels than their peers who are not enrolled in an allied health graduate program (Bogardus et al., 2021; Kafeel et al., 2018; Macauley & Plummer, 2017; Webber et al., 2020). Elevated anxiety levels are also reported for health professions graduate students (Bullock et al., 2017), and medical students (Adhikari et al., 2017; Ediz et al., 2017; Fawzy & Hamed, 2017).

Parent History of Anxiety and STAI Score

As suggested by the stress-diathesis model, the diathesis component of anxiety may be related to traits, specifically, anxiety in this study, inherited from one or both parents. To examine the relationship between a parental history of anxiety and participant anxiety, the question "Have you been told, or do you perceive that one or more of your parents/guardians regularly experiences anxiety," was asked with answer choices "yes," "no," "unsure," and "prefer to not answer." Most participants (58%) replied "yes"; however, reporting a family history of anxiety did not statistically significantly impact any of the STAI scores both at baseline and for the STAI-s repeated measures score within 30 minutes of taking an exam. This finding contrasts with a large survey study (n = 1,238) of DPT students by Bogardus (2019). In this study there were significant differences, using Mann Whitney U tests, for depression (U = 190,743), anxiety (U = 186,396), and stress scores (U = 192,635,5), as measured by the Depression Anxiety Stress Scale (DASS), for DPT students with a family history of a mental health disorder when compared to those without.

Although additional studies examining the relationship between family anxiety and DPT student anxiety were not found, several prospective studies (Huizink et al., 2004; O'Connor et al., 2002; Van den Bergh & Marcoen, 2004) suggest that the children of mothers who experience increased anxiety levels during pregnancy have more emotional and behavioral problems. Likewise, Turner et al. (1987) found that children born to parents with a history of anxiety were more likely to be diagnosed with anxiety than those without. Considering the small sample size of the current study, and the findings reported by prior studies, the influence of a family history of anxiety on DPT student anxiety requires further investigation.

Impact of Anxiety Management Strategies

When asked whether participants have a specific strategy to manage anxiety, most participants (n = 31, 72.1%) reported "yes." The most commonly reported anxiety management strategy was exercise (83.7%), followed by talking with a friend/loved one (69.8%), and relaxing (62.8%). However, participants who reported having an anxiety management strategy did not have statistically significant differences on any of the STAI scores when compared to those who did not report having a strategy.

This finding is consistent with a study by Thomas-Davis et al. (2020) that measured stress and anxiety in occupational therapy students and DPT students and reported that talking with friends (76%), listening to music (76%), exercise (62%), prioritizing and planning (52%), and drinking (24%) as the most commonly reported anxiety reduction strategies. Like this study, Thomas-Davis et al. (2020) did not describe statistical relationships showing a decrease in anxiety for those using anxiety reduction strategies.

On the other hand, a study by Williams et al. (2018) surveyed 163 DPT students about anxiety, stress, and coping mechanisms found then when participants reduced how much time they spend engaging in anxiety reduction strategies, which occurred as the semester progressed, levels of stress and anxiety, as measured by the DASS-21 increased. Like those in this study, participants in the Williams et al. study (2018) reported exercise during the past week (95%) as the most common anxiety reduction strategy.

Although this study and those by Williams et al. (2018) and Thomas-Davis et al. (2020) did not measure the intensity of the exercise used by participants to reduce anxiety, a study by Broman-Fulks et al. (2004) found a statistically significant relationship between aerobic exercise and self-rated anxiety for participants engaging in aerobic training exercises on a treadmill.

Those who participated in high-intensity training experienced more rapid reductions in a global measure of anxiety when compared to those who participated in low-intensity exercise. However, like this study, Broman-Fulks et al. (2004) did not find a significant relationship between aerobic exercise and anxiety when the STAI was used to measure anxiety. Considering the findings in this study, as well as prior studies, the impact of exercise, as well as other anxiety reduction strategies, on anxiety appears challenging to adequately measure. Additional studies, with more sophisticated reporting, along with defined intervention strategy protocols for each intervention, are needed to determine the impact of anxiety reduction strategies on anxiety in DPT students.

Other Anxiety Management Strategies

This study contained three open-ended opportunities for participants to report additional/other anxiety management strategies in addition to the eight listed on the data collection questionnaire. Refer to Table 7 on page 77 for the list of strategies provided on the questionnaire and participant responses. The most commonly reported "other" strategy was "breathing" (n = 10), followed by "having a positive outlook" (n = 5). However, a statistical relationship between those using these strategies and their reported level of anxiety, as measured by the STAI, was not statistically significant.

The use of breathing and positive thinking as anxiety reduction strategies may be considered components of the broader intervention mindfulness. A study by Barbosa et al. (2013) examining the use of mindfulness-based stress reduction training for graduate healthcare students, including DPT students, found it to reduce anxiety. The training used in this study involved eight 2.5-hour weekly classes plus an 8-hour silent day-long retreat. These findings are like those of prior mindfulness training studies that have reported mindfulness interventions

successful in reducing anxiety for nurses (Cohen-Katz et al., 2005) and medical students (Rosenzweig et al., 2003). Additional studies examining the relationship between mindfulness training and anxiety reduction in DPT students are warranted.

Perceived Sources of Anxiety

To determine sources of anxiety not reflected by the structured questions on the data collection questionnaire, the open-ended question "What makes you most nervous?" was asked. "Failure" was the most reported response to this question (n = 12), followed closely by "not knowing the material" (n = 9), and "the consequences of poor performance" (n = 7). These responses are similar to the findings of a large survey study of DPT students, which reported that a fear of failure increases anxiety in DPT students (Bogardus et al., 2021). The relationship between a fear of failure, with a resulting drive for perfectionism, causing an increase in DPT student anxiety was also described by participants who participated in the qualitative portion of this study. This was not surprising considering that the NU DPT program dismisses students who fail a course and/or who have more than 12 credits of coursework below a 3.0 grade.

Similar to the findings in this study, a recent study examining 1,916 graduate health science students by Bogardus et al. (2022) found relationships between social perfectionism and depression, anxiety, and stress, with self-oriented perfectionism correlating more strongly with anxiety and stress. Because the number of responses describing other sources of anxiety in this study is small, the relationship between these sources and anxiety remains unknown. Additional, larger studies are needed to determine what other factors may be causing anxiety in DPT students.

Implications for Future Practice and Research

This study investigated the potential causes of anxiety in DPT students through the lens of the stress-diathesis model. The "diathesis" component was measured by examining trait characteristics, such as having a history of anxiety and parental educational level. The "stress" component was captured by measuring the influence of environmental factors such as taking a test, the type of test, year in school, income, and the number of hours worked per week.

The results of this study found that DPT students at Neumann University are experiencing levels of anxiety, as measured by the STAI, higher than normative populations, which increases prior to taking a test. As mentioned in the introduction, increased levels of anxiety, especially when prolonged, can negatively impact health and well-being. Considering these factors, those responsible for DPT education should take steps to minimize the anxiety experienced by DPT students.

To ensure broad changes for all students, the Commission on Accreditation in Physical Therapy Education (CAPTE), the accrediting agency for physical therapy education, should consider adding to its standards a requirement for all institutions providing DPT education to provide resources for anxiety management. Specifically, CATPE standard 2B4, states "program resources are meeting, and will continue to meet, current and projected program needs including, but not limited to, financial resources, staff, space, equipment, technology, materials, library and learning resources, and student services," should add in its description a requirement that mental health services be available to DPT students. Adding this language to CATPE standard 2B4 would provide a mechanism of accountability to ensure institutions providing DPT education would address the need for anxiety-reduction strategies for their students.

In addition, at the institutional level, colleges and universities with DPT programs should have programs in place to address anxiety beginning from the time of enrollment to ensure that DPT students have access to free anxiety reduction programs such as mindfulness and behavioral therapy counseling. Finally, at the program level, DPT faculty should consider ways to reduce anxiety among students, especially during test-taking. The addition of review sessions, increased availability of faculty for student meetings, and/or implementation of tests that can be taken more than once may be helpful. Future studies examining the effectiveness of specific anxiety-reduction interventions are needed to provide guidance for best-practice methods. Furthermore, additional studies are needed to look at other factors such as self-efficacy, self-care, and the influence of educational strategies on anxiety in DPT students. Qualitative studies may also be helpful to capture constructs not represented in this study.

This study was limited by the small sample size and because the students were all from the same university. In addition, this study used a measurement of anxiety that captured the participants' perception of anxiety and did not include a method for physiologically measuring stress and anxiety. Future studies should be larger and include a broader heterogenous group of students for results to be applied to the broader population of DPT students in the United States. Finally, intervention studies that objectively measure anxiety to determine which strategies are most effective at reducing anxiety are needed to improve the quality of life for DPT students.

Conclusion

Consistent with prior research, this study found elevated levels of anxiety in DPT students. There was a statistically significant increase in anxiety when measured again within 30 minutes of an exam. The type of exam did not influence the amount of increase; however, the

repeated anxiety measure was limited to either a written exam or practical exam, while students reported comprehensive exams to be the most anxiety-provoking.

This study found a statistical relationship between participants reporting that they were currently experiencing anxiety and their STAI score, showing that those reporting anxiety scored higher on a standardized measure of anxiety. In addition, inverse relationships were found for older students and those working more hours per week showing that as age increases anxiety decreases, and when participants worked more hours, their anxiety significantly decreased. This study did not find a relationship between anxiety, as measured by the STAI and gender, the number of life roles, race, income, year in school, and parental anxiety and/or parent education. However, the generalizability of these results is limited due to the decreased number of participants in this study and the homogenous nature of the study participants.

Similar to existing literature, the use of exercise as an anxiety management strategy was reported by the majority (84%) of participants. Talking with a friend or loved one, as well as relaxing, were also reported by the majority. In addition, strategies such as breathing and positive affirmations were common open-ended responses. However, the results of this study did not find a statistical relationship between the use of anxiety reduction strategies and lower anxiety, as measured by the STAI.

The results of this study affirm that DPT students at Neumann University are experiencing greater levels of anxiety than reported by other studies for normative populations. Although the scope of this study was limited, its findings contribute to the growing body of literature attempting to determine what is causing elevated anxiety in this population. Considering these findings, educators and institutional administrators involved in DPT education must take action to provide effective anxiety management strategies for DPT students.

Additional, larger studies with objective measures of anxiety are needed to further investigate the causes, and separately, to determine which interventions are most effective in reducing anxiety in DPT students. This work is necessary to preserve both the mental and physical health of this population.

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Appendix A

Data Collection Instrument

Identifier Code: _____ Birth Month:_____

Section 1: Demographic information

1. **Select your current gender identity:**

__Female __Male ___Non-binary ___None listed… I identify as_____

__Prefer to not answer

2. **Select your current racial identity:**

__White __Black ___Hispanic ___Asian ___Native American ___ Pacific Islander

___None listed… I identify as_____ ___Prefer to not answer

3. **Please enter your age in a whole number.**

   Age _____

4. **Please select your current year of enrollment within a Doctor of Physical Therapy (DPT) program**
   - __ First year
   - __ Second year
   - __ Third year
   - __ Prefer to not answer

5. **Please enter your current GPA _____**
   □ If unknown, check the preceding box to grant permission to have your advisor provide. (Form will remain de-identified.)
   □ If unknown, check the preceding box to deny permission.

6. **During the past 6 months please enter the average number of hours you have worked (outside coursework) per week?**

   Average number of hours worked per week: _____

7. Is your current annual household income from all sources…

__Less than $15,000
__$15,001 to $25,000
__$25,001 to $35,000
__$35,001 to $50,000
__$50,001 to $75,000
__$75,001 or more

8. Indicate the highest education level completed by each of your parents or guardians…

Parent/Guardian #1	**Parent/Guardian #2**
□Some grade school □Finished grade school □Finished high school/GED □Associates degree □Bachelor's degree □Master's degree □Graduate/Professional degree (MD, DPT, PhD, EdD,	□Some grade school □Finished grade school □Finished high school/GED □Associates degree □Bachelor's degree □Master's degree □Graduate/Professional degree (MD, DPT, PhD, EdD, DHSc etc)

9. Have you been told, or do you perceive that one or more of your parents/guardians regularly experiences anxiety?

__ Yes __ Unsure
__ No __ Prefer to not answer

10. Are you a first-generation graduate student in your family?

__ Yes __ No __ Other

Section 2: Sources of anxiety

These next questions are about your perceived sources of <u>anxiety</u>.

11. In addition to being a DPT student enrolled at Neumann University, please select all of the life roles below that currently apply. (You may select more than one.)

__ Spouse or partner
__ Caretaker for children
__ Caretaker for parents
__ Employed
__ Volunteer
__ Member of church or other organization

__ Other (please describe) _____

12. Have you experienced increased levels of anxiety at any point in your life PRIOR to becoming a DPT student at Neumann University?

__Yes
__No
__Prefer to not answer

13. Aside from being a student at Neumann University, please indicate the amount of worry you typically experience on a scale from 1 (not at all worried) to 5 (extremely worried) currently on a daily basis. (Select one number only.)

__1 (not at all worried) __2 (Slightly worried) __3 (Somewhat worried) __ 4 (Moderately worried) __5 (Extremely worried)

For each of the activities below, occurring with the context of Neumann's DPT program, indicate the amount of worry you experience on a scale from 1 (not at all worried) to 5 (extremely worried).

14. **Taking a written test (either on paper or on the computer)**

__1 (not at all worried) __2 (Slightly worried) __3 (Somewhat worried) __ 4 (Moderately worried) __5 (Extremely worried)

15. **Taking a practical exam**

__1 (not at all worried) __2 (Slightly worried) __3 (Somewhat worried) __ 4 (Moderately worried) __5 (Extremely worried)

16. **Taking a comprehensive exam**

__1 (not at all worried) __2 (Slightly worried) __3 (Somewhat worried) __ 4 (Moderately worried) __5 (Extremely worried)

17. What makes you most nervous?

_____

_____

_____

18. List any physical symptoms that occur to you when taking a test: (ex. sweating, dry mouth, rapid HR, etc)

_____

_____

19. What sources of anxiety do you perceive to most impact test-taking as a DPT student at Neumann University:

Section 3: Anxiety Management

20. Do you have a specific strategy to manage your anxiety?

__ Yes
__ No

21. If yes, please list the strategies you use to help manage your anxiety (ex. exercise, medication, meditation, etc.)

22. Do you experience *test taking anxiety* that you perceive interferes with your academic performance?

__ Yes
__ No

23. How do you typically manage your anxiety? (you may select more than one)

__ Exercise __Medication __Other (Please describe below)
__ Talking with a friend or loved one __Alcohol
__ Meditation __Psychotherapy
__ Relaxing __Hobby

24. Using the scale from 0 (none at all) to 5 (extremely) how much external support (including emotional, physical and financial), from friends and family members do you receive on a regular basis?

__1 (No support) __2 (Slight support) __3 (Some support) __ 4 (Moderate support) __5 (Extreme support)

25. Please enter any additional comments related to how you manage anxiety:

---

26. Please enter any additional comments related to this study:

SCORES

27) Baseline State Trait Anxiety Inventory, State Subscale (STAI-S) score: ____

28) Baseline State Trait Anxiety Inventory, Trait Subscale (STAI-T) score ____

29) Stratification into practical or written group (even birth month = "P" practical group; odd = "W" written group: _____

30) Repeated Measures State Trait Anxiety Inventory (STAI-S) score: ____

Appendix B

Permission to use STAI

Permission for Heather Anderson to reproduce 160 copieswithin three years of July 2, 2021

State-Trait Anxiety Inventoryfor Adults™

Instrument and Scoring Key

Developed by Charles D. Spielberger

in collaboration with R.L. Gorsuch, R. Lushene, P.R. Vagg, and G.A. Jacobs

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The above-named person has made a license purchase from Mind Garden, Inc. andhas permission to administer the following copyrighted instrument up to that quantitypurchased:

State-Trait Anxiety Inventory for Adults

The four sample items only from this instrument as specified below may be included inyour thesis or dissertation. Any other use must receive prior written permission from Mind Garden. The entire instrument may not be included or reproduced at any time in any other published material. Please understand that disclosing more than we have authorized will compromise the integrity and value of the test.

Citation of the instrument must include the applicable copyright statement listed below.

Sample Items:

I feel at easeI
I feel upset
I lack self-confidenceI

I am a steady person

Sincerely,

Robert Most, Mind Garden, Inc

Appendix C

Consent Form

Identifier Code _____

Title: *Anxiety in Doctoral of Physical Therapy Students*

Principle investigator: Heather Anderson PT, DPT

Institution affiliated with research: Neumann University (NU) One Neumann Drive, Aston, PA 19014

Location of data collection: NU, RAB building, One Neumann Drive, Aston, PA 19014

Invitation to participate: You are invited to participate in a research study examining the relationship between anxiety levels for DPT students and various personal traits as well as environmental factors such as the type of assessment. It has been well established that DPT students have higher levels of anxiety than age-matched peers. Currently the factors contributing to this anxiety are not fully understood. The results of this pilot study should provide preliminary answers that will contribute to larger and more broad studies. Once the underlying factors are understood steps can be taken to reduce anxiety for this population which should improve their qualify of life and overall health and wellness.

Basis of subject selection: This study is seeking normal subjects ages 18-70 who are currently enrolled at NU DPT who did not participate in developing this study or evaluating the pilot data questionnaire. Participants willing to participate must sign this consent letter which will be secured within the Physical Therapy department at Neumann University (NU). Testing will occur on the campus of Neumann University in the RAB building floor in two phases. Phase one which should take 20 minutes or less, will involve learning about the study, signing the consent, completing the data collection questionnaire, and completing the entire STAI. Phase two will occur within 30 minutes of either a written or practical exam and involve completing just the State portion of the STAI electronically on Blackboard. Phase two should take less than 4 minutes. Individuals who do not sign the consent form will not be eligible to participate in the study. Participants may choose to withdraw from the study at any time. Data collection will occur between September and November during 2021.

Complications or injuries: Because our study is not performing any treatments on human subjects, it does not pose the risk of any physical harm. Considering that our study examines the conditions that cause anxiety, there is a chance that participants may have a heightened awareness of anxiety which could increase stress. This is not intended to occur but must be acknowledged. The intent of the study is to ultimately determine a way to reduce anxiety for the study population.

Your participation in this research project is voluntary; you may choose to withdraw at any time. Your responses will be confidential; no individual will be named in the reporting of the research findings. To protect privacy, all results and consent forms will be locked in separate file cabinets within the PT department office at NU. To protect the identity of study participants from the rest of the faculty, the sheet matching the unique identifier codes with those on the consent forms will be locked within a file drawer within the primary investigators office and be destroyed once the second State STAI forms are completed on Blackboard.

I have read and received a copy of this consent form. I voluntarily consent to participate in the research project described herein. My rights as a subject of this research have been explained.

Printed Name & Title:_____

Signature of participant or legal representative _____

Date: _____

Signature of principal investigator: _____ Date:_____